Draft Program Environmental Impact Report
for

Inland Aquaculture Projects






January 2003

Prepared for:

California Department
of Fish and Game

Prepared by:

FishPro, Inc.
and
ENTRIX, Inc.

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Sacramento, California

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Contents

Tables

Figures

SECTION 1. EXECUTIVE SUMMARY

This Program Environmental Impact Report (also referred to as a Program EIR or PEIR) is intended to serve as an aid to applicants of new inland aquaculture projects in California or those making changes to existing projects. It is also intended that this document serve as a learning tool for project reviewers who may be unfamiliar with the range of activities in the aquaculture industry. From a technical standpoint, this Program EIR is a "first-tier California Environmental Quality Act (CEQA) document". Tiering is a method that strives to streamline the environmental review by providing an initial document that analyzes broad issues of a program. As an approved CEQA document, this PEIR may be incorporated by reference into subsequent "second-tier" environmental documents prepared for individual aquaculture projects. This approach allows the second-tier analysis to focus only on the impacts of the individual project. Depending on project components and complexity, the product of the second-tier analysis for an individual project will be a Negative Declaration, Mitigated Negative Declaration, or an Environmental Impact Report.

California has the most diverse aquaculture industry in the United States. The state's size, combined with its particular geology and topography, provide a multitude of climatic and water conditions suitable for a variety of growing conditions. In recent years, about 50 to 75 percent of the state industry value has come from the production of fresh water food fish, including catfish, striped bass and hybrid striped bass, tilapia, sturgeon and trout. About 10 percent of the value is derived from marine shellfish, primarily oysters and abalone. Most of the remaining value comes from a variety of non-foodfish products such as baitfish, ornamental fish, and algae developed for use as a nutritional supplement or food additive. While a vast majority of California production involves common aquaculture products, it is worth noting that numerous other species are currently cultured to a lesser extent or have strong candidate status based on successful culture in other parts of the world.

Aquaculture projects can generally be categorized by the method used to rear the product. Several of these methods are appropriate only to marine species reared in coastal environments, while other rearing methods are used only for freshwater species in an inland setting. Regulations that govern these two broad geographic settings are often very different, particularly with respect to protection of resources within those environments. For this reason, two programmatic EIRs have been prepared to address the California aquaculture industry: one for coastal marine projects and one for inland projects. This PEIR pertains to inland aquaculture projects.

Four categories of inland aquaculture production have been defined in this PEIR based on distinguishing characteristics of the physical and/or operational setting of each method. These four methods are:

- pond culture
- raceway or tank culture

- recirculating systems
- in-water cage culture

Ponds are the most common method used for inland aquaculture production in California, based on responses received for the national aquaculture census (USDA 1998). Ponds are most frequently used for the production of warmwater species such as catfish and tilapia, though in cooler climates they are also used for species such as trout and juvenile salmon. Raceways and tanks are usually smaller rearing units and are constructed of concrete, fiberglass or metal. They generally have greater flow control and a larger flow rate than ponds. Raceways and tanks are suitable for rearing almost any species. Recirculating systems are typically comprised of several raceway or tank rearing units, but are characterized by the addition of water treatment equipment that allows water reuse and greater productivity when there is limited flow availability. Cage culture is typically used for the growout of finfish species. Greater detail regarding both the typical physical components and standard operating procedures for each rearing method is presented in Section 3 of this PEIR.

Aquaculture is a heavily regulated industry in California and in the United States in general. First and foremost, every proposed commercial aquaculture project in California must be approved by the California Department of Fish and Game (CDFG). An initial step in the aquaculture permit process involves a screening of the species to be reared. If the proposed species raises concerns relating to issues such as (but not limited to) introduction of exotic species, escapement, and disease transfer, CDFG will identify additional operating conditions and permits that must be addressed prior to final project approval. Section 2 of this PEIR provides a discussion of specific aquaculture activities that require additional permit approval, and in this way suggests methods a project can be operated to avoid or minimize certain potential impacts.

Additional regulations invoked during aquaculture project review insure 1) compliance with local land use policy and 2) protection of natural resources, most commonly in the areas of fish and wildlife habitat and water. Again, Section 2 of this PEIR describes actions that frequently trigger the need for these local and resource agency permits. Avoiding or minimizing the issues addressed by these permits can do much to expedite the permit approval process. It is common that the following permits will be required for inland aquaculture projects:

- A grading permit will be required by most counties if the project involves pond construction.
- A Conditional Use Permit will be required by some counties (but not all), even on land zoned for agriculture.
- A waste discharge requirement (WDR) or NPDES permit may be required by the Regional Water Quality Review Board.
- A CDFG Streambed Alteration Agreement will be required if the project involves a water supply intake or outfall located in a natural water course.

- A US Army Corps of Engineers Form 4345 will be required if the in-water facilities are located in navigable waters.

Site-specific characteristics of an individual aquaculture project may invoke additional regulatory review, but it is not within the scope of this PEIR to address site-specific issues. For example, the site of a proposed individual aquaculture project may contain unique cultural resources protected by federal or state statute, or it may be located in an area of special aesthetic value that requires review of scenic impacts. Section 2 provides project preplanning recommendations that encourage project proponents to work with local planners to identify potential site-specific issues as early as possible and to subsequently act upon any permit and site development requirements associated with these issues. Similar to the approach presented for general aquaculture activities, if it is possible to avoid or mitigate potential impacts to these site-specific resources during the project planning stages, then it is possible that a project can be approved without having to develop an environmental impact report (EIR) for the individual project.

Section 5 of this PEIR provides a programmatic environmental review of potential adverse impacts that may occur with inland aquaculture projects. The review is organized using the same 16 resource categories defined in the Environmental Checklist Form presented in the 1998 amendment of the CEQA Guidelines. Within each resource category, the checklist prompts the reviewer to examine a spectrum of activities that potentially could result in significant environmental effects if they were to occur with the project. It is important to note, however, that the checklist is not intended to represent an all-inclusive list of potentially significant environmental effects, and each resource category discussion in the PEIR may address additional activities not identified on the checklist that are common in the aquaculture industry.

A key aspect of the CEQA analysis is determining whether or not an activity may result in a significant adverse environmental effect. CEQA regulations purposefully do not define specific thresholds of significance, because the significance of an activity may vary with the setting. Instead, CEQA regulations authorize and encourage local governments to adopt thresholds that most appropriately reflect local and agency policies. A threshold of significance can be defined as a quantitative or qualitative standard, or set of criteria, pursuant to which the significance of a given environmental effect may be determined. A threshold may be based on standards such as the following (GOPR 1994):

- A health-based standard such as water pollutant discharge standards, air pollutant emission standards, or noise levels.
- Service capacity standards such as traffic level of service, water supply capacity, or waste treatment plant capacity.
- Ecological tolerance standards such as physical carrying capacity, impacts on declared threatened or endangered species, or wetland encroachment.

Based on a programmatic level of analysis, inland aquaculture projects potentially may

cause significant adverse environmental effects in two resource categories, as noted in the table that follows. At the same time, there are numerous examples of mitigation measures implemented at existing aquaculture facilities that have a proven track record of successfully reducing these potential impacts to levels that are less than significant. These mitigation measures are described in Section 5 following each mention of a potentially significant adverse impact. For many proposed individual aquaculture projects, all issues relating to potentially significant adverse impacts will have been eliminated by avoiding sensitive habitat and by incorporating effective mitigation strategies directly into the facility design during project planning stages.

Resource Category	Potentially Significant Adverse Impact
Biological Resources	• Impact to sensitive species or sensitive habitat (such as wetlands or riparian habitat) displaced by project facilities • Impact to aquatic organisms and in-stream habitat caused by diversion of surface water for facility use • Impact on natural aquatic populations due to accidental introduction of exotic species and/or exotic pathogens • Impact on natural aquatic populations due to escapement and subsequent competition for habitat and food
Hydrology and Water Quality	• Reduction of water tables due to groundwater appropriation • Water quality impact from discharge of excess feed and feces or from pond drawdown during harvest • Temporary increase in siltation during facility construction

As a Program EIR (PEIR), this summary list of potentially significant adverse impacts does not include site-specific issues (such as aesthetics and cultural resources) that may arise due to the unique characteristics of an individual project location. Instead, this list identifies potentially significant adverse impacts that are likely to occur based on the typical operation and facility development associated with inland aquaculture projects. During the preplanning stages of an individual aquaculture project, it is feasible that a project proponent can avoid or effectively mitigate all potential impacts of the project, whether they be programmatic or site-specific in nature. The CEQA process ensures that analysis of site-specific issues will be conducted during the review of an individual project application, as well as ensuring that the mitigation measures recommended for programmatic activities are appropriate for the specific site.

Both the U.S . Department of Commerce and the state of California have implemented aquaculture policies that encourage increased development of the aquaculture industry, citing benefits to economic activity, native fish stocks, commercial and recreational fishing, and effective use of land and water resources. At the programmatic level, this

common state and national objective suggests just two alternatives for the California inland aquaculture industry. The Preferred Alternative consists of approving new project applications through the current set of regulations governing the aquaculture industry, recognizing that appropriate site-specific mitigation shall be developed in the course of approving discretionary permits for the individual project. The No-Project Alternative assumes that no new aquaculture projects will be approved in California, and that the industry will continue at existing facilities and at present levels of production.

It has been demonstrated repeatedly in the U.S. that aquaculture projects can be constructed and operated with no significant adverse impacts to the environment. The aquaculture industry is subject to numerous regulatory requirements, and the environmental review process in California insures that proposed individual projects will undergo a site-specific investigation to the appropriate level of detail and with adequate public review. On this basis, the Preferred Alternative is the recommended avenue for achieving the growth objectives of both the state and federal policy and the aquaculture industry.

SECTION 2. THE APPROVAL PROCESS FOR CALIFORNIA AQUACULTURE

2.1 PURPOSE OF THIS PROGRAM ENVIRONMENTAL IMPACT REPORT

This Program Environmental Impact Report (also referred to as a Program EIR or PEIR) is intended to serve as an aid to applicants of new aquaculture projects in California. It is recognized that California's process for environmental review and permit approval is one of the most rigorous in the nation. Information in this document describes regulations governing the aquaculture industry, identifies activities that may trigger permit requirements, and gives examples of common mitigation practices. Incorporating this information into the planning and conceptual design of a proposed aquaculture facility may help a project applicant simplify the environmental review and permit approval process.

At the same time, this document is intended as a learning tool for project reviewers who may be unfamiliar with the range of activities in the aquaculture industry. There is tremendous diversity in the products sold by the industry, but at the same time there are many common elements in the methods used to produce those products. This document provides an overview of the common rearing methods and hence the common potential environmental impacts that occur in the industry.

From a technical standpoint, this Program EIR is a "first-tier CEQA document." CEQA, which is the acronym for the California Environmental Quality Act, was enacted in 1970 as a system of checks and balances for land-use development and management decisions in California. Tiering is a method that strives to streamline the environmental review by providing an initial document that analyzes broad issues of a program. As an approved CEQA document, this PEIR may be incorporated by reference into subsequent "second-tier" environmental documents prepared for individual aquaculture projects, regardless of whether the second-tier document is a Negative Declaration, Mitigated Negative Declaration, or an Environmental Impact Report (EIR). This approach allows the second-tier analysis to focus on site-specific impacts of the individual project and to provide a more in-depth analysis of specific topics, as needed. Additional discussion of the benefits and requirements of tiered documents is presented later in this section.

2.2 OVERVIEW OF THE CEQA REVIEW AND PERMIT APPROVAL PROCESS

Aquaculture development in California, like any other land use action that may potentially affect the environment, is regulated by a set of environmental review requirements defined in the California Environmental Quality Act (CEQA). The CEQA review process is rigorous by any standard. There are numerous built-in safeguards that ensure public involvement and participation as well as opportunities for localities and agencies to work cooperatively with the project applicant. A common product of the CEQA process for a specific project is a single document that summarizes the diverse environmental concerns of the permit agencies, the land use decision agency, and the general public. Depending on project components and complexity, the CEQA document may by a Negative Declaration, Mitigated Negative Declaration, or an EIR. This PEIR may serve as a first-tier document to any of these project-specific documents.

Aquaculture projects generally require several permits. The industry involves an

interaction with several natural resources that are regulated by local, State and Federal legislation. In many cases, the permit authority of these agencies provides a means of granting project approval while conditioning project operations to protect significant resources. In general, any aquaculture project that requires a discretionary permit is likely to be subject to CEQA review.

When a project requires approval from more than one permit agency, a **lead agency** must be determined. A lead agency is that permit agency that has the principal responsibility for carrying out or approving a project and preparing CEQA documents. Most often, the locality in whose jurisdiction a project is proposed will serve as the lead agency.

Once the lead agency is identified, all other involved permit agencies, whether Federal, State or local, become **responsible agencies**. Except in rare instances, responsible agencies do not prepare their own environmental review documents. The procedure by which each responsible agency issues its particular development permit is governed by the particular law which establishes the permit authority and by the California Permit Streamlining Act (PSA) (Government Code Section 659920-65963.1).

A third classification of agency involvement with the CEQA process involves the **trustee agencies**. The trustee agencies are the four California entities that have jurisdiction over certain resources held in trust for the people of California: the California Department of Fish and Game (CDFG), the State Lands Commission, the California Department of Parks and Recreation, and the University of California. In general, trustee agencies must be notified of any CEQA documents relevant to their jurisdiction, providing an opportunity for consultation and comment on the project. It is worth noting that a CEQA review of any aquaculture project will involve CDFG in its trustee function, overseeing the protection of fish and wildlife of the state, native plants designated as rare or endangered, game refuges, and ecological reserves. In addition, CDFG will be involved as a responsible agency, having a legal responsibility for carrying out and approving the aquaculture registration permit.

The permit process is independent yet integral to the CEQA process. Prior to the issuance of any permit, the responsible agency must consider potential environmental consequences of activities to be conducted under the requested permit. These concerns are summarized in the CEQA documents prepared by the lead agency. Usually a responsible agency will issue a decision on a permit application only when the CEQA review is complete.

A CEQA review may involve up to three separate, consecutive phases. Typical activities occurring in each phase are described below and summarized in Figure 2-1.

- The first phase consists of a preliminary review conducted by the lead agency to determine whether a project is subject to CEQA. In general, if a project requires a discretionary government approval (which is the case with many aquaculture permits), then it is likely that CEQA applies. If on the other hand the lead agency determines that there is no possibility for a significant environmental impact, that the proposed activity does not meet the CEQA definition of a "project," or that the project is covered by any of four categories of exemptions, then it may approve the project and complete the CEQA review process.

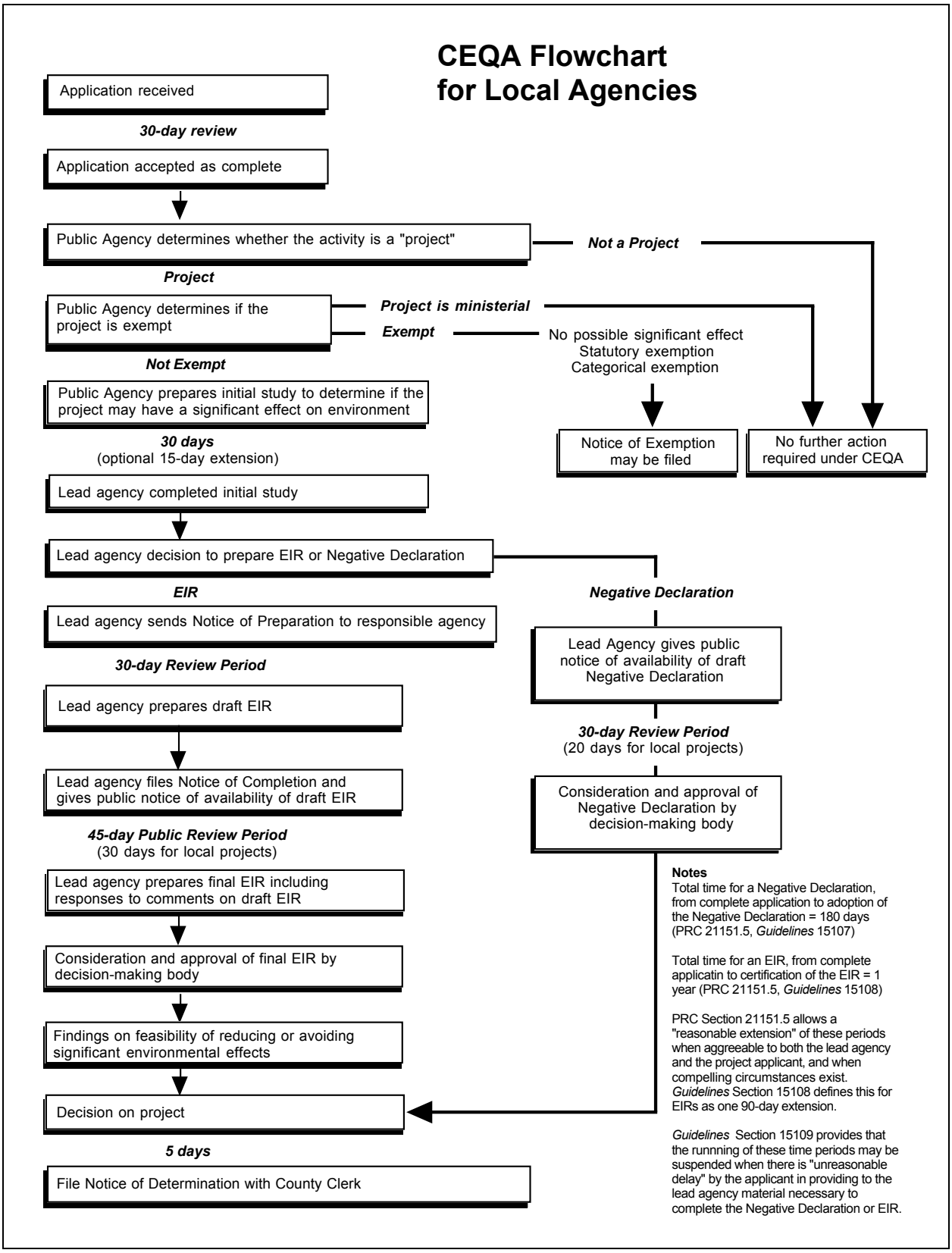

Figure 2-1. CEQA flowchart for local agencies (source: GOPR 1998).

- In cases where the project applicant is not a public entity (as with most aquaculture projects), the preliminary review will also determine whether the project is subject to the PSA. The PSA requires government agencies complying with CEQA to process these projects within State-mandated time limits. Where PSA applies, the lead agency has 30 days beyond the time an application is determined to be complete to a) assess whether CEQA applies and b) subsequently conduct an initial study as described in Phase Two below.
- The second phase of CEQA review involves preparation of an Initial Study to determine whether the project will require a Negative Declaration, a Mitigated Negative Declaration or an EIR. The Initial Study is prepared by the lead agency in consultation with the responsible agencies. In cases where the project involves a tiered analysis, the Initial Study must indicate that significant effects presented in the first-tier document were adequately addressed, or otherwise indicate specific areas requiring more detail or a site-specific analysis. A Negative Declaration can be prepared if the study concludes that the project, without mitigation, will not have a significant effect on the environment. If there are potential significant effects that will be clearly mitigated through project conditions agreed to by both the project applicant and the affected agencies, then a Mitigated Negative Declaration can be prepared. Otherwise, an EIR will be required. In this latter case, the Initial Study should also identify the specific potential significant effects on which the EIR will focus, so that the EIR can avoid unnecessary analysis of those effects that are not potentially significant or that have been adequately addressed in the first-tier document (such as this PEIR).
- The third phase of CEQA review involves preparation of the Negative Declaration, Mitigated Negative Declaration or EIR as decided in Phase Two. In all cases, a draft document is prepared by the lead agency and reviewed by the public and relevant agencies. Comments received on the draft document are taken into consideration in a final document that becomes the basis for the lead agency decision on the project.

When the CEQA review process is completed, a Notice of Determination (NOD) is issued by the lead agency. Following the NOD, responsible agencies typically must act within six months to complete permit applications previously submitted for the project.

This Program EIR may be useful to the lead agency during all three phases of CEQA review. This document identifies common practices of aquaculture that have potential to cause significant environmental effects, and it also describes standard mitigation measures and regulatory requirements that typically reduce the effect to a less than significant condition. Project applicants for individual aquaculture projects should be encouraged to consult with the lead agency to identify site-specific concerns relating to land development, for example, to identify whether wetlands, cultural resources, or endangered species may be present at the proposed site. If there are no site-specific concerns, or if the project description clearly identifies mitigation measures that will be implemented to avoid or minimize environmental effects, then it should be appropriate to complete the CEQA review process with a Negative Declaration or Mitigated Negative Declaration. If there are significant environment effects expected following implementation of all feasible mitigation measures, then it will be necessary to prepare an EIR. These project-specific CEQA documents can most likely be streamlined by stating they are tiered to this PEIR and noting where this document is available for review.

During the preliminary review of an individual aquaculture project, a Lead Agency may conclude there are potential significant effects from the project that were not considered or not adequately addressed in this PEIR. In such cases, the Lead Agency must conduct an Initial Study that analyzes the additional effects, leading subsequently to either a Negative Declaration, Mitigated Declaration, or EIR for the individual project. It is assumed that this PEIR will still benefit the environmental review process and will be incorporated by reference into the Initial Study and the subsequent environmental document.

2.3 COMMON PERMIT REQUIREMENTS FOR AQUACULTURE

As an aid to determine the State and local permits required for a project, the California Office of Permit Assistance suggests the following questions be asked (COPA 1997):

- Where is the project **located**?
- What specific **activities** does the project involve?
- What **resources** are affected by the project?

Generally, the **location** and geographic area of a project will determine the lead agency responsible for CEQA review and may indicate the need for additional land development permit requirements. Early contact with these agencies may be the most influential factor in expediting the permit process. With respect to **activities**, every proposed commercial aquaculture project in California will be required to obtain an Aquaculture Registration permit from the California Department of Fish and Game (CDFG). Depending on the species to be cultured and the proposed specifics of the project, CDFG may identify additional aquaculture permits required for operation. Finally, the **resources** most likely to be affected by aquaculture projects involve fish and wildlife habitat and water. The protection of fish and wildlife habitat is assured by CDFG during the same review process that provides approval of the Aquaculture Registration permit, and through Department regulation of approved facilities. Water resources may be affected in two ways, either by the use of surface or groundwater sources as a facility water supply or by the discharge of facility wastes into surface water. The agencies providing review for the protection of water resources are likely to be the Regional Water Quality Control Board and/or CDFG, depending on the proposed project.

Table 2-1 provides a listing of permits that are commonly required for inland aquaculture projects, grouped by the three categories noted in the questions above. Not all of these permits will be required of a project, and in many cases a specific operating plan and detailed facility design will be required before a determination can be made on permit requirements. The subsections following the table provide a summary of key concerns of each permitting agency. In many cases there is discussion on operating conditions or threshold conditions that triggers the need for a permit; conversely, the avoidance of these activities can eliminate the need for a permit. A more detailed discussion of many of these regulatory requirements can be found in A Guide to California State Permits, Licenses, Laws and Regulations affecting California's Aquaculture Industry (ICAD 1994).

Table 2-1. Example permit screening for California inland aquaculture projects.

Permit	Agency	Required for:
LOCATION AND GEOGRAPHIC AREA		
Land Use Permit and/or CEQA Review	City or County Government	Compliance with local regulations and State environmental review requirements
Development Permit	Tahoe Regional Planning Agency	Lake Tahoe Watershed
Encroachment Permit	The Reclamation Board	Floodways in the Central Valley
AQUACULTURE ACTIVITIES		
Aquaculture Registration	Department of Fish and Game	The culture and husbandry of aquatic organisms, including, but not limited to, finfish, shellfish, and algae.
Standard Live Fish Importation Permit	Department of Fish and Game	Importation from out of State of most live aquatic species
Long-term Live Fish Importation Permit	Department of Fish and Game	Importation of aquatic species; on an ongoing basis that do not represent a significant concern for potential impacts on State wildlife resources.
Health Certificate by Appropriate Out of State Agency	Department of Fish and Game	Importation of salmonids and other aquatic species.
Private Stocking Permit	Department of Fish and Game	Generally required for aquaculture products stocked in the State, except for sales between aquaculturists registered with the Department for the species in question
Wild Broodstock Collection Permit	Department of Fish and Game	Permission to collect wild stock for use in developing a domestic broodstock
Permit for Exotic or Restricted Species	Department of Fish and Game	Species not established in California or listed as detrimental
Addition of Species to Individual Certificates of Registration	Department of Fish and Game	Adding species to the current registration list
Aquarium Dealers Permit	Department of Fish and Game	Aquarium dealers wishing to sell sturgeon or abalone; must be obtained from registered aquaculturists and sold as pets
Certification of Growing Water	Department of Health Services (Environ. Mgmt. Branch)	All shellfish harvested commercially for human consumption
Shellfish Handling and Marketing Certificate	Department of Health Services (Food and Drug Branch)	Shellfish dealers
Weighmaster Registration	Department of Food and Agriculture	Those who sell aquaculture products by weight

(continued next page)

Table 2-1. (Cont.)

Permit	Agency	Required for:
RESOURCES		
Notification of Streambed Alteration	Department of Fish and Game	Change (divert/obstruct) the bed, channel or bank of any river, stream or lake
Department of the Army Permit (Form 4345)	U.S. Army Corps of Engineers District Office	Anyone proposing to locate a structure, excavate, or discharge dredged materials into the waters of the U.S.
Permit to Appropriate Water	State Water Resources Control Board	Any aquaculturist who plans to divert water from a surface or underground stream, or store water seasonally in an onstream or offstream reservoir
Statement of Water Diversion and Use	State Water Resources Control Board	Diversion of water under a riparian claim of an appropriative right initiated prior to Dec. 19, 1914
Geothermal Water Permit	Department of Conservation or local County (e.g. Imperial Co.)	Use of low temperature geothermal water (between 80 and 212 degrees F)
Report of Discharge	Regional Water Quality Control Board	Any aquaculturist discharging, or proposing to, waste that may affect water quality
National Pollution Discharge Elimination System (NPDES) Permit	Regional Water Quality Control Board	Any facility discharging waste into any surface waters of the State

2.3.1 Location and Geographic Area

The entity most likely to be responsible for the CEQA review of an aquaculture project is the local City or County that governs the project location. There are currently 58 counties and approximately 468 incorporated cities in California. The local government should be consulted early in the planning process to determine which local zoning ordinances may pertain to the project. The local government is likely to be the lead agency in the CEQA review process.

Cities and counties regulate land use by way of planning, zoning, and subdivision controls. State law authorizes cities and counties to adopt local ordinances and rules consistent with State law. Some activities are permitted by right and others are permitted only by special use authorization – nearly all are subject to CEQA.

Every city and county in California has adopted a general plan to guide local land development. Typically the general plan contains a map that identifies the allowable land uses. Each general plan must contain seven elements covering land use, circulation, housing, open space, safety, conservation, and noise.

Development projects must apply for a development permit from the city or county in which the proposed project is to be located. The city or county determines whether: 1) it complies with the city or county general plan, and 2) it is exempt from CEQA.

If the city or county determines that the project is inconsistent with the general plan, the developer – applicant must apply for a general plan amendment. General plan amendment procedures are as follows:

- After completing an environmental analysis of the project, the planning commission holds a public hearing on the proposal.
- At the hearing, the planning commission considers recommendations from the city or county planning department, interested agencies, and public testimony.
- After the commission completes its deliberations, it forwards a recommendation to the governing body.
- The governing body holds a public hearing on the proposal in which it may approve, deny or modify the proposed amendment after the public hearing.
- If the governing body modifies the amendment, it must refer it back to the planning commission for reconsideration prior to taking final action.

Certain geographic areas of California have additional permit requirements that serve to protect special features of the area. Examples include permits issued to projects located in the Lake Tahoe watershed or in floodways in the Central Valley. Consultation with the county government should identify whether any special geographic permits exist for a specified project location.

2.3.2 Aquaculture Activities

Aquaculture in the state of California has been classified through legislation to be an agricultural activity, and it is therefore regulated under the same statutes and benefits offered to the agriculture industry as a whole. At the same time, the nature of aquaculture results in its crossing into the regulatory purview of many other agencies. Foremost, every commercial aquaculture project in California must register with CDFG, which makes a determination on the acceptability of the species to be reared and the facility design. Governing codes and regulations include Fish and Game Code 15102, which states aquaculture operations may be prohibited "where it is determined it would be detrimental to adjacent native wildlife"; and the chapter in the California Code of Regulations pertaining to aquaculture (CCR Title 14, Division 1, Chapter 9 [Sections 235-245]). In addition, specific production activities may dictate the need for other permits from a State or local entity. The precise need and governing regulations for these permits will be dictated by the location of the project as well as the specific design and operational features.

2.3.2.1 Aquaculture Registration

To conduct an aquaculture business, which entails the commercial rearing of live aquatic plants or animals for food, bait or stocking into public waters, or for other commercial sale, *each* operator must complete and submit an **Aquaculture Registration Application** (Form FG 750) to CDFG. The same application is required of owners or operators of fishing ponds where customers pay a fee for the fish, or are able to fish, without regard for the California sportfishing regulations (such as license, season, and limit requirements). The application form can be obtained from the following location:

CDFG License and Revenue Branch
3211 South Street
Sacramento, California 95816
Telephone (916) 227-2271

2.3.2.2 Obtaining or Moving Aquatic Species

The CDFG regulates the importation, transportation, stocking, and possession of aquatic species to prevent the introduction of undesirable species to bodies of water where they do not already exist, and to prevent the dissemination of fish diseases and parasites to wild populations and cultured stocks. Registered aquaculturists are allowed to transport live product within the State under conditions provided for in regulation specified in the California Code of Regulations (CCR), Title 14, Chapter 9 (beginning with Section *235*.

Certain species are designated as Detrimental by the Commission through their listing in Section 671, Title 14, CCR. These are species that the Commission has determined to be undesirable, or a menace to native wildlife, the agricultural interests of the State (including aquaculture), or to public health or safety. A special permit is required for possession of any of these species for any purpose, including aquaculture. Normally, these species are not approved for aquaculture purposes.

Regulations require a permit to import live aquatic plants and animals for aquaculture. All imported aquatic plants and animals are subject to inspection to make certain unwanted species, diseases, and parasites are excluded. Live aquatic plants and animals may be imported into California under the terms of two different types of permits issued by CDFG. They are Form FG 786 (Long-term Importation Permit) and Form FG 789 (Standard Importation Permit). The Standard Importation Permit is the type of permit required for the importation of most aquatic species. This permit is for a single shipment, and the shipment is often inspected.

Under certain conditions, live aquatic animals may be imported under the provisions of a Long-term Importation Permit. This type of permit is intended for repeated importations under the same conditions (same species from the same origin to the same destination). To qualify for this type of permit, the risk of introducing diseases, parasites, or undesirable species with the imported animals must be very low. Examples are animals which:

1) are taken from drainages absent diseases, parasites, or exotic species of concern,
2) normally will not be maintained alive in the waters of the State, or
3) the CDFG has reason to believe harbor no known new fish diseases or parasites of concern which might be introduced to waters of the State.

Examples are Sacramento blackfish, carp and other fin fish taken from the wild and held alive until retailed in food markets. Also, Long-term Permits have been issued for certain species, including crayfish and other aquatic invertebrates, used as live bait for sportfishing.

Long-term Importation Permits are issued at the discretion of the CDFG for periods of up to one year from the date of issue. Inspections of live aquatic animals imported under the provisions of a Long-term Permit may be conducted at the discretion of the Department.

Applications for both types of importation permits and information on these permits may be obtained from the following location:

CDFG Fisheries Programs Branch
1416 Ninth Street
Sacramento, California 95814
Telephone (916) 455-3597

At times, stocks of plants or animals may be unavailable from commercial sources in California and CDFG has the authority to allow collection, from the wild, of plants or animals to be used in developing the cultured domestic stock. A registered aquaculturist may apply for collection of wild species using Application for Wild Broodstock Collection Permit (Form FG 794) obtainable from the Fisheries Programs Branch office noted above.

Private stocking (release) of aquaculture product into State waters is regulated by Section 238.5 of Title 14, CCR, which may require a Private Stocking Permit (Form FG 749). The permit application can be obtained from the Fisheries Programs Branch office.This permit, when approved, allows stocking of an aquaculture product by a private party into State waters.

Authorization to sell two specific aquaculture products, white sturgeon and abalone, in the aquarium trade requires a special permit. The aquarium dealer must apply to CDFG using Aquarium Dealer's Application and Permit to Sell White Sturgeon and Abalone Raised as Aquaculture Products (Form FG 972) , obtainable from the Fisheries Programs Branch office. A number of conditions are included in the permit to assure that the animals are from an appropriate source and are sold as pets and not to be stocked into waters of the State.

2.3.2.3 Shellfish Aquaculture

The cultivation of bivalve molluskan shellfish (freshwater clams and mussels) for human consumption is also regulated by the Department of Health Services (DHS). This agency is responsible for ensuring that these shellfish are grown in waters meeting a standard of cleanliness and for approving handling, packaging and quality standards of the product. These regulatory needs are necessary to certify that a healthful product is supplied to the public.

Water quality in shellfish growing areas is approved through the Environmental Management Branch of DHS. The aquaculturist must submit an **Application for Shellfish Growing Area Certificate** (Form SSP 11). The Food and Drug Branch of DHS administers the facility, handling, packaging and quality standards. This process is initiated with the submission of the **Shellfish Handling and Marketing Certificate**.

2.3.2.4 Business Requirements

Because aquaculture is designated as an agricultural industry it must comply with certain sections of the Food and Agriculture Code. The Department of Food and Agriculture regulates aquaculture with the **Weighmaster Registration**. An aquaculturist selling product by weight must complete the weighmaster registration.

2.3.3 Resources

2.3.3.1 Fish and Wildlife Habitat

Permits are likely to be required if the development of an aquaculture facility will divert or obstruct the natural flow or substantially change the bed, channel or bank of any river, stream or lake, or use materials from the streambed. CDFG reviews these activities with the filing of the **Notification of Removal of Materials and/or Alteration of Lake, River, or Streambed Bottom or Margin** (Form FG 2023). If the project involves

activities that would locate a structure, excavate or discharge dredged materials into waters of the U.S. or to transport dredged materials for the purpose of dumping it into ocean waters, then the U.S. Army Corps of Engineers (COE) permit **Application for Department of the Army Permit** (Form 4345) is required. For projects within the San Francisco Bay Area counties these activities may be permitted using the **Joint Aquatic Resources Permit Application (JARPA)**. This consolidated permit is filed with CDFG and the COE to meet their individual regulatory concerns.

2.3.3.2 Water Resources – Use of State Waters for Water Supply

Water is an essential and critical component of any aquaculture operation. Maintaining the highest water quality possible is a concern of the State Water Resources Control Board, and the Regional Water Quality Control Boards that regulate water use and monitor water quality, and the aquaculturists as well. Good water quality is necessary to produce a high quality aquaculture product.

To divert water from a surface or underground stream, or any other body of water, or to store water seasonally in an onstream or offstream reservoir the aquaculturalist must apply to the State Water Resources Control Board, Division of Water Rights using the **Permit to Appropriate Water**. The use of purchased water, or the pumping of water that freely percolates though the ground water basin by the overlying landowner does not require a water right permit. The continued use on an appropriative right established prior to December 19, 1914, and the proper exercise of a riparian right do not require a water right permit but require an informational filing of a **Statement of Water Diversion and Use** with the State Water Resources Control Board. This statement of activity allows the Division of Water Rights to notify water users of requests by others to use water that might affect their established right.

The use of low temperature geothermal water (80-212^{o}F) is regulated by the Department of Conservation, Division of Oil and Gas, Geothermal Section. Division of Oil and Gas permits are required for those individuals responsible for drilling and maintaining the geothermal well. Imperial County reserves the authority for permitting geothermal wells.

2.3.3.3 Water Resources – Wastewater Discharge

Maintenance of water quality and the protection of water resources in the State are the legislated responsibility of the State Water Resources Control Board. The State of California also has primacy for water quality and implements a large portion of the Federal Clean Water Act. There are nine Regional Boards, which regulate waste discharge through the **Waste Discharge Requirements (WDR)** permit. In addition the Boards also administer the **National Pollution Discharge Elimination System (NPDES)** permits in California.

Any aquaculture activity that may discharge waste that could affect water quality must file **Form 200 Report of Discharge** to the appropriate Regional Water Quality Control Board office. If the discharge is to surface waters of the State, U.S. Environmental Protection Agency (USEPA) **Form 3510-2B** must also be filed with the regional office. The Regional Board will then review the forms and issue the appropriate permits (WDR and/or NPDES) depending on the size and other components of the operation.

2.4 STRATEGIES FOR AQUACULTURE PERMIT APPROVAL

2.4.1 Project Planning

The process of developing a plan for an aquaculture facility involves a balance of competing factors. In order to remain in business, an aquaculture facility must be able to operate profitably, utilizing natural and human resources in a cost-effective manner. At the same time, the project must comply with regulations that protect environmental resources. Proactive measures to reduce environmental impacts through the proposed design and operation of a facility may simplify and expedite the CEQA review and permit approval process.

Issues relating to aquaculture projects can usually be placed into two categories: those that involve the specific species and rearing methods proposed for culture, and those that relate to site characteristics. Very early in the planning stages, project proponents should discuss project concepts with **both** the **Department of Fish and Game** and the **local City or County government**. Discussions should focus on items that can trigger the need for additional permits or special facilities, as described in the following paragraphs.

Preparing a draft version of the Aquaculture Registration Application may be a useful way to approach an initial consultation with the Department of Fish and Game. The form requires the applicant to identify the species to be maintained at the facility, the source of the water supply, and the proposed method of preventing organisms from entering or escaping at the facility inlet and outlet locations. Applicants need to be aware that certain species are prohibited from importation and culture, and other species require special approval. Information regarding special species requirements can be found in free Informational Leaflets that can be obtained from the office of the Aquaculture Coordinator in the Department of Fish and Game:

CDFG Aquaculture Coordinator
1416 Ninth Street
Sacramento, California 95814
Telephone (916) 455-4034

Applicants are also encouraged to review information in the aquaculture permit guide (ICAD 1994) that can be obtained for $10 from the same office, which contains many of the permit application forms noted in Table 2-1. During the initial consultation, the Department can give some indication of the level of baseline information, special facility design features, and post-operational monitoring that may be required depending on the proposed culture species. The applicant should incorporate these recommendations into the facility development plan as soon as possible and evaluate their potential cost implications, or consider switching to an alternate culture species that has simpler and more standard rearing requirements.

Early in the planning stages, the applicant should also strive to collect as much information as practical regarding site-specific characteristics of the project location. Specific items of concern include the presence of wetlands, riparian habitat, critical habitat for sensitive species, floodplains, aesthetic resources, and cultural resources. In many cases, the local government may have existing surveys that indicate the potential risk of finding these resources on a particular site. Early consultation with the local planning agency can help identify high-risk resources which suggest the need for more

data. The ability to confirm the presence or absence of special resources on a site can influence facility design. Efforts made during the preliminary design stages to avoid or minimize impact on special resources through structural siting or operational planning will often result in an overall decrease in cost by reducing the need for facility redesign.

2.4.2 Twelve Helpful Tips

The following common sense tips are offered by the Office of Permit Assistance (COPA 1997) to make the CEQA review process easier. As suggested in the previous subsection and in the first tip below, an early consultation with the Department of Fish and Game, the local government and other key agencies can help an applicant clearly understand the process, make sure that assumptions have been addressed, and identify timelines. Once this early consultation has helped resolve conceptual ideas to avoid problem areas, the other 11 tips can help to make the process move more smoothly.

1. CONSULT EARLY	Consultation with permitting and regulatory agencies should begin as early as possible in planning your project. At this point potential concerns can be addressed with the appropriate individuals.
2. USE THE SERVICES OF THE CALIFORNIA OFFICE OF PERMIT ASSISTANCE	The staff of the California Office of Permit Assistance will help identify the regulatory agencies, set up meetings with them, and will help facilitate expeditious permit reviews.
3. WRITE A COMPLETE PROJECT DESCRIPTION	A complete project description is crucial. See the next subsection for how to write a complete and accurate project description.
4. LEARN THE RULES	Take time to study the protocols and regulations of those agencies that must approve your project. Study all applicable State, local and Federal agency permitting requirements.
5. KNOW THE REGULATORS	Become familiar with the regulators and how they function. Attend meetings. Read previous staff reports, permit conditions, and studies relating to your project.
6. REDUCE ADVERSE ENVIRONMENTAL IMPACTS	Design your project to eliminate or reduce as many potential health concerns and environmental impacts as possible. Consider environmentally superior alternatives. Incorporate the suggestions you learned during early consultation. Retain a competent consultant.
7. INVOLVE THE PUBLIC	Plan a public participation program. Meet with them, get their ideas and views. Use press releases and announcements to keep them informed about the progress of your project. Avoid surprises.
8. DO NOT APPROACH THE PROCESS WITH AN ADVERSARIAL ATTITUDE	It is generally counterproductive to resist the permit process as you are going through it. An adversarial attitude often results in hostility and could delay your project.
9. PAY ATTENTION TO DETAILS	Follow all the rules. Respond promptly to requests for information. Be on time for meetings with representatives of the regulating agencies. Do not cut corners. Get in writing all dates, procedures, fees, etc.
10. BE WILLING TO NEGOTIATE	Recognize that government regulators have a great deal of authority over your project. But they are willing to negotiate and you should be, too.

11. SELECTING YOUR SITE	Exercise your usual due diligence. Do not secure rights to a site without studying the environmental constraints and surrounding land uses. Evaluate alternative sites.
12. WHEN IN DOUBT, ASK	If you are not sure whether your project needs a permit or whether it is regulated at all, ask. Get written confirmation. Going ahead without following the proper guidelines will ultimately cost you more time, money and goodwill.

2.4.3 The Components of a Good Project Description

Presenting the lead agency with a concise and comprehensive project description is crucial to the smooth processing of a development application. Conversely, a vague description which does not accurately represent the proposal or a description which is in a state of flux makes processing unnecessarily time-consuming. Extra time spent at the beginning of a project writing a good project description can save processing time down the line. As the project progresses and agency recommendations are developed to reduce or mitigate impacts, it will facilitate the permit process to incorporate discussion of these issues and responses in the project description of any subsequent permit applications.

The Office of Permit Assistance (COPA 1997) suggests that a good project description should contain the following elements:

(a) The precise location, boundaries, and physical characteristics of the proposal illustrated on a local map and a plot plan. The type of map may vary depending on the project scope and the terrain.

(b) A general description of the project's physical, operational, and environmental characteristics. These may include, but are not limited to, the following, as applicable:

- the size of the project site;
- existing and proposed land uses;
- existing general plan and zoning designations, and any proposed changes;
- the species being cultured and the proposed rearing methods;
- the size of proposed structures;
- the roads which will provide access and any proposed improvements;
- expected levels of traffic on those roads;
- impact on public works such as water and sewer, and any proposed improvements related to the project;
- impacts on applicable air quality, water quality, drainage, and noise standards and proposed actions to meet those standards;
- any natural systems which would be disrupted (riparian habitat, wetlands, animal and plant life, etc.); and
- any historic structures or archaeological sites which would be disturbed;

- quantity of air emission and/or discharge based on equipment to be used;

(c) A list of the specific permits or other approvals being applied for and the various agencies involved.

The project description should be sufficiently detailed to allow permitting agencies to determine how their regulations and requirements would apply. Contacting permitting agencies informally before filing an application to discuss the project and applicable regulations and requirements can help inform you of the items that should be included in the project description.

2.5 BENEFITS AND REQUIREMENTS OF THE PROGRAM EIR

The following section contains information regarding the statutory requirements for preparation of a Program EIR. This information may be of greater relevance to agencies involved with environmental review of aquaculture projects, though project applicants may also find it useful in understanding the CEQA process.

2.5.1 Benefits of Program EIRs

CDFG has prepared this PEIR to assist in the regulation and approval of future individual aquaculture projects. PEIRs are typically prepared for regulatory programs to evaluate the broad environmental effects of the implementation of the regulatory process with the acknowledgment that site-specific environmental review may be required for specific projects. By definition, actions that provide for a PEIR include:

- Activities that are linked geographically
- Activities that are logical parts of a chain of contemplated events
- Rules, regulations, or plans that govern the conduct of a continuing program
- Individual activities carried out under the same authorization statutory or regulatory authority and having generally similar environmental effects that can be mitigated in similar ways.

Through the preparation of a PEIR, the following objectives are met:

- Consideration of impacts and alternatives that would not be practical in an individual EIR
- Focus on cumulative impacts that might be slighted in a case-by-case analysis
- Avoidance of continual reconsideration of recurring policy issues
- Consideration of broad policy alternatives and programmatic mitigation measures at an early stage when the agency has greater flexibility to deal with them
- Expedite the permitting process within State regulatory agencies by providing standard mitigation measures.

Within this PEIR, broad program-wide impacts, management strategies, and program-wide mitigation measures have been evaluated. The site-specific effects caused by aquaculture facilities are to be reviewed and considered within subsequent permit applications on a project-by-project basis. These subsequent project-specific environmental documents may incorporate the PEIR by reference, pursuant to 40 CFR 1502.24 and Section 15150 of the CEQA Guidelines.

To determine impacts, it was necessary to anticipate the types of aquaculture projects likely to be proposed in the future. Based on our current understanding of the industry, the project description (Section 3) describes the various inland aquaculture alternatives

likely to be proposed in the future. An impact assessment was then conducted for these aquaculture alternatives. Broad environmental issues identified in this PEIR include:

- Adverse and beneficial impacts on existing aquatic species and sensitive habitat
- Adverse and beneficial impacts on birds and mammals
- Adverse and beneficial impacts on water quality

As the aquaculture industry continues to evolve, future projects will need to be reviewed for their similarities and differences to those addressed in the PEIR. Project activities not defined in this document will require additional environmental analysis in project-specific CEQA elements.

2.5.2 CEQA Requirements of the Program EIR

This PEIR has specifically been prepared by CDFG to analyze and disclose the potential environmental effects of California inland aquaculture projects. Accordingly, this PEIR reviews generic inland aquaculture projects and establishes a tiering framework for subsequent project-specific environmental reviews. It also seeks to achieve a number of important objectives established by CEQA. The key principles that guided the preparation of the analyses contained in this PEIR are described briefly in the following.

Legal Compliance. This PEIR complies with the California Environmental Quality Act (CEQA), in order to achieve legal compliance.

Reasonably Feasible Analyses. CEQA Guidelines, Section 15151 states the standard for adequacy of an EIR is:

> *An EIR should be prepared with a sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure.*

Significant Effects, Mitigation, and Alternatives. As noted in the California Public Resources Code (Section 21002.1) and the CEQA Guidelines (Sections 15002(a) and 15003), the focus of analysis in an EIR or PEIR should be on three key elements:
1) the significant effects of the proposed action or project;
2) mitigation measures that will minimize significant effects; and
3) consideration of a reasonable range of alternatives that reduce the significant effects.

In addition, CEQA sets forth certain mandatory findings of significance (CA Pub. Res. Code Section 21083 and CEQA Guidelines Section 15065). According to CEQA, a project will have a significant effect if it will:

- Substantially degrade environmental quality;
- Substantially reduce fish or wildlife habitat;
- Cause a fish or wildlife habitat to drop below self-sustaining levels;
- Threaten to eliminate a plant or animal community;
- Reduce the numbers or range of a rare, threatened, or endangered species;
- Eliminate important examples of the major periods of California history or prehistory;

- Achieve short-term goals to the disadvantage of long-term goals;
- Have possible environmental effects that are individually limited but cumulatively considerable when viewed in connection with past, current, and reasonably anticipated future projects.
- Have environmental effects that will directly or indirectly cause substantially adverse effects on human beings.

To be considered adequate, mitigation measures should be specific, feasible actions that will actually improve adverse environmental conditions. Mitigation measures should be measurable to allow monitoring of their implementation.

The range of alternatives required in an EIR is governed by a "rule of reason" that requires an EIR to set forth only those alternatives necessary to permit a reasoned choice. An EIR need not consider every conceivable alternative to a project. Alternatives must be limited to ones that meet the project objectives, are ostensibly feasible, and would avoid or substantially lessen at least one of the significant environmental effects of the project.

Understandable to the Public. The PEIR should be accessible and understandable to the informed lay public. A major intent of CEQA is to provide adequate public participation throughout the entire process in a good faith effort to solicit public input for the EIR. Documents must adequately address reasonable concerns raised by the public during the process (CA Pub. Res. Code Sections 21092 - 21092.5 and CEQA Guidelines, Section 15200 - 15204).

Objective Criteria and Substantial Evidence. The analysis and determination of significant effects related to a project should:

1) be based upon objective criteria used to define "thresholds of significance." For example, thresholds of significance may be based on criteria defined in adopted standards, regulations, policies or plans. **A change in the environment is not a significant effect if it complies with a standard that meets all of the following criteria:**
   - The standard contains a quantitative, qualitative, or performance requirement found in a statute, ordinance, resolution, rule, regulation, order, or other standard of general application.
   - The standard was adopted for the purpose of environmental protection.
   - The standard was adopted by a public agency through a public review process to implement, interpret, or make specific the law (enforced or administered by that agency).
   - The standard applies within the jurisdiction where the project is located.

   Noncompliance with these performance levels would normally be determined to be a significant impact and compliance would normally be determined to be considered less than significant;
2) take in to account certain types of impacts that invoke mandatory findings of significance as outlined in CEQA;
3) be based upon substantial evidence, such as factual or scientific data to support conclusions regarding the significance of effects. This evidence must be in the record, either in the EIR or adequately referenced and available to the public; and,
4) include direct and indirect impacts, short-term and long-term impacts, cumulative and growth-inducing impacts. This includes examining the context of the impacts

(e.g. local and statewide) and the intensity of the impacts (CEQA Guidelines, Sections 15064, 15065, 15126(a, b, e, f & g), 15130, 15382, Appendices K and G).

Mitigation Tied to Specific Impacts. Identified mitigation measures are tied to specific significant adverse impacts. Mitigation measures are proposed to minimize significant effects. Mitigation can potentially avoid, minimize, rectify, reduce or eliminate, or compensate for impacts. Good mitigation measures will explain: 1) the objective of the measure; 2) a specific action to be implemented that will result in real and measurable change to the impact; 3) who will be responsible for implementing and monitoring the action; and 4) a schedule for implementation (CEQA Guidelines, Sections 15126(c) and 15370).

Decision-making Orientation. Each EIR and PEIR provides the basis for findings and decisions made by the Lead Agency and Responsible Agencies. Once a final EIR or PEIR is completed, the agencies must provide a written record regarding the conclusions of the document and the choices made about the proposed project or action. When approving a project in compliance with CEQA, agencies must make specific findings regarding each significant impact identified in the project EIR. These findings must state that either: 1) mitigation measures adopted will reduce the impact to a less-than-significant level; or 2) that it is not feasible to mitigate the significant impact, but that there are other overriding considerations for approving the project anyway (CEQA Guidelines, Sections 15091 & 15092).

Program Review and Tiering. This PEIR considers broad measures, subsequent CEQA review requirements, and programwide mitigation measures. The site-specific effects of inland aquaculture program approval are to be reviewed and considered within subsequent environmental documents on a project-by-project basis. These subsequent project-specific environmental documents may incorporate this PEIR by reference, pursuant to Section 15150 of the CEQA Guidelines. CEQA encourages the use of policy-level documents and tiering, as outlined in the following.

Section 15168(a) of the CEQA Guidelines states:

A program EIR is an EIR which may be prepared on a series of actions that can be characterized as one large project and are related either: (1) Geographically; (2) As logical parts in the chain of contemplated actions; (3) In connection with issuance of rules, regulations, plans, or other general criteria to govern the conduct of a continuing program; or (4) As individual activities carried out under the same authorizing statutory or regulatory authority and having generally similar environmental effects which can be mitigated in similar ways.

CEQA, in Public Resources Code Section 21068.5, defines tiering as:

...the coverage of general matters and environmental effects in an environmental impact report prepared for a policy, plan, program or ordinance followed by narrower or site-specific environmental impact reports which incorporate by reference the discussion in any prior environmental impact report and which concentrate on the environmental effects which (a) are capable of being mitigated, or (b) were not analyzed as significant effects on the environment in the prior environmental impact report.

Good Faith Disclosure. This PEIR makes a good faith attempt to fully disclose the effects of the proposed action. The function of CEQA documents is to provide full disclosure to the public and decision-makers on the issues and facts regarding the environmental aspects of a proposed project or action. The environmental documents

do not make decisions for governmental agencies, but rather they provide useful information that allows for public discussion and debate, and for decision-makers to ultimately make a choice (CA Pub. Res. Code, Section 21002.1 and CEQA Guidelines, Sections 15002(a) and 15003).

Short-Term Uses Versus Long-Term Productivity. Section 15126(e) of the CEQA Guidelines explains that the PEIR should address *"The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity"*, and that *"Special attention should be given to impacts which narrow the range of beneficial uses of the environment or pose long-term risks to health or safety."* The following considers the continued development of aquaculture facilities in light of these requirements.

Commercial aquaculture in California provides nearly 37 million pounds of product annually. Industry's objective is to create economic opportunities in aquaculture while protecting natural biological resources, water quality, human health, and the environment. By doing so, commercial aquaculture can continue in an environmentally sound and sustainable fashion. Compliance with mitigation measures set out in this PEIR will enable a significant beneficial use of water resources without undue short-term or long-term impact to other resource categories. Commercial aquaculture complements efforts to restore and maintain sustainable wild stock fisheries in order to maximize the benefits of aquatic and ocean resources for U.S. citizens.

Irreversible or Irretrievable Commitments. Section 15126(f) of the CEQA Guidelines explains that the PEIR should address *"Any significant irreversible environmental changes which would be involved in the proposed action should it be implemented."* The following considers the aquaculture industry in light of this requirement.

With proper mitigation and site-specific environmental review, aquaculture facilities can continue to be constructed and operated within California without irreversible environmental change. By relying more on commercial aquaculture products, and less on the consumption of wild species, aquaculture can also help facilitate the recovery of native species currently in danger of extinction, such as salmon species.

SECTION 3. PROGRAM DESCRIPTION

3.1 STATE AND FEDERAL VISIONS OF THE AQUACULTURE INDUSTRY

The state of California recognized the potential of aquaculture in 1979 with passage of SB 52, commonly referred to as the California Aquaculture Development Act. The Act declares that the practice of aquaculture should be encouraged in order to augment food supplies, expand employment, promote economic activity, increase native fish stocks, enhance commercial and recreational fishing, and protect and better use the land and water resources of the state. The Act also establishes a policy and program aimed at improving the science and practice of aquaculture as a means of expanding aquaculture industry and related economic activity in the state. The California Aquaculture Development Act can be found in Division 1, Chapter 4 of the California Public Resources Code.

The National Aquaculture Development Act of 1980, amended in 1985, set the stage for coordinating the efforts of the U.S. Departments of Agriculture (USDA), Commerce (DOC) and Interior (DOI) in a plan to develop the aquaculture industry in the United States. The aquaculture policy subsequently developed by DOC has a stated mission to create sustainable economic opportunities in aquaculture in a manner that is environmentally sound and consistent with applicable laws. The mission statement notes the following benefits that can accrue from this policy:

- The mission complements and is an integral part of DOC efforts to restore and maintain sustainable wild stock fisheries in order to maximize the benefits of coastal resources for U.S. citizens.
- Aquaculture can make major contributions to the local, regional, and national economies by providing employment and by creating business opportunities.
- The United States can lead the world in the development of aquaculture technologies and advance international guidelines for the industry in order to maintain a healthy environment.

Specific objectives of the DOC aquaculture policy by the year 2025 include:

- Increase the value of domestic aquaculture production from the present $900 million annually to $5 billion, which will help offset the $6 billion annual U.S. trade deficit in seafood.
- Increase the number of jobs in aquaculture from the present estimate of 180,000 to 600,000.
- Double the value of non-food products and services produced by aquaculture in order to increase industry diversification.
- Enhance depleted wild fish stocks through aquaculture, thereby increasing value of both commercial and recreational landings and improving the health of our aquatic resources.

3.2 OVERVIEW OF THE CALIFORNIA AQUACULTURE INDUSTRY

The origins of the aquaculture industry in California can be traced back to the 1850s, when the sudden influx of human population resulted in an intense fishing pressure and rapid decline in natural stocks of the Native oyster (Conte et al. 1996). To meet the market demand, Native oysters were collected from other West Coast bays and transported into San Francisco Bay, where they were maintained in oyster beds and subsequently marketed throughout central California. Until the early 1900s, San Francisco Bay was the site of the largest oyster industry on the West Coast. The expansion of the population, with resultant water quality degradation, reduced the capability of the Bay to produce high quality oyster meat.

Today the aquaculture industry is among the fastest growing segments of United States agriculture. In 1974 the value of products sold by the US aquaculture industry was $45 million, but by 1998 this value increased to more than $978 million (USDA 1998). In the first national census ever conducted for the aquaculture industry, the value of California's aquaculture industry was reported at $45 million, making it the eighth greatest aquaculture producer in the nation (USDA 1998). However, two regional aquaculture surveys suggest the California production value is higher, in the vicinity of $71 million to $83 million, based on a total live weight production of 31 to 36 million pounds (WRAC 1999; CAA 1999). Production summary statistics from all three sources are presented in Table 3-1. It has been suggested that the low values of the national census are probably an undercount attributable to the first-time action of the survey.

California has the most diverse aquaculture industry in the United States (Conte 1990). The state's size, combined with its particular geology and topography, provide a multitude of climatic and water conditions suitable for a variety of growing conditions. In recent years, about 50 to 75 percent of the state industry value has come from the production of fresh water food fish, including catfish, striped bass and hybrid striped bass, tilapia, sturgeon and trout (Table 3-1). About 10 percent of the value is derived from marine shellfish, primarily oysters and abalone. Most of the remaining value comes from a variety of non-foodfish products such as baitfish, ornamental fish, and algae developed for use as a nutritional supplement or food additive. While a vast majority of California production involves common aquaculture products, it is worth noting that numerous other species are currently cultured to a lesser extent or have strong candidate status based on successful culture in other parts of the world. These additional species and products are noted in Table 3-2.

Every commercial aquaculture producer in California is required to register with the Department of Fish and Game. CDFG classifies each registrant into one of two categories, marine or freshwater. As of April 2000 there were 220 registered aquaculture facilities in the state, with 176 being classified as freshwater facilities and the remaining 44 being marine projects. In some cases, the same aquaculturist may be registered more than once due to having more than one production facility. The 176 existing freshwater aquaculture projects are distributed throughout California, with industry representation in nearly every county (Figure 3-1).

Table 3-1. California aquaculture production as reported by three sources.

Source: USDA 1998

	Wholesale Value ($)	Number of Farms
Food Fish	31,143,000	83
Baitfish	2,178,000	7
Ornamental Fish	1,701,000	12
Sport or Game Fish	365,000	9
Other Fish	(withheld)	2
Crustaceans	(withheld)	4
Mollusks	4,710,000	14
Other Animals and Plants	4,271,000	6
Total	43,509,000	120

Source: WRAC 1999

	Wholesale Value ($)	Live Weight (lbs)
Catfish	11,288,000	6,102,000
Trout	5,310,000	2,966,000
Tilapia	8,775,000	4,500,000
Other Food Fish	8,800,000	6,225,000
Non-Foodfish	14,719,000	1,008,000
Aquatic plants	13,760,000	1,037,000
Oysters	4,017,000	7,952,000
Mussels	535,000	458,000
Other shellfish	3,389,000	292,000
Total	70,593,000	30,540,000

Source: CAA 1999

	Wholesale Value ($)	(%)	Live Weight (lbs)	(%)
Catfish	11,000,000	13%	6,240,000	17%
Striped/hybrid bass	9,000,000	11%	3,671,000	10%
Tilapia	7,500,000	9%	3,671,000	10%
Sturgeon	7,000,000	8%	2,569,000	7%
Trout	6,800,000	8%	2,937,000	8%
Shellfish			5,139,000	14%
Oysters	3,900,000	5%		
Abalone	3,200,000	4%		
Other shellfish	1,000,000	1%		
Algae	13,500,000	16%	10,278,000	28%
Other			2,202,000	6%
Baitfish	1,800,000	2%		
Other Food Fish	1,500,000	2%		
Brineshrimp	8,700,000	10%		
Other aquatic animals	6,500,000	8%		
Aquatic plants	2,000,000	2%		
Total	83,400,000	100%	36,707,000	100%

Table 3-2. Common and potential products for the California aquaculture industry.

Freshwater Production	Marine Production
Common Products	*Common Products*
Algae	Oysters
Catfish	Abalone
Striped/hybrid bass	Mussels
Tilapia	Clams
Sturgeon	Scallops
Trout	
Other Products	*Other Products*
Black bass	Limpets
Carp	Urchins
Koi/Goldfish	Halibut
Minnows	Orangemouth Corvina
Mosquito fish	Red Drum
Ornamental fish	Salmon (adults)
Sacramento blackfish	White Seabass
Salmon (juveniles)	Algae
Sunfish/Bluegill	Aquatic plants
Crayfish	
Prawns	
Aquatic plants	
Frogs	
Worms, tubifex	

While there is a great variety of product produced by the industry, all facilities share a common need for consistent, good quality water. Cultured species have well defined and often rigid constraints in their water quality requirements, and ambient conditions such as water temperature, turbidity, dissolved oxygen levels, and cleanliness (especially the absence of human and non-human pathogens) will most often be the primary factor in determining which species might be reared successfully in a given water supply. It should be emphasized that the key to aquaculture production is the ability to sustain water quality conditions. Any departure from these water quality conditions will have a direct impact on the productivity of a facility and ultimately on its long-term economic viability.

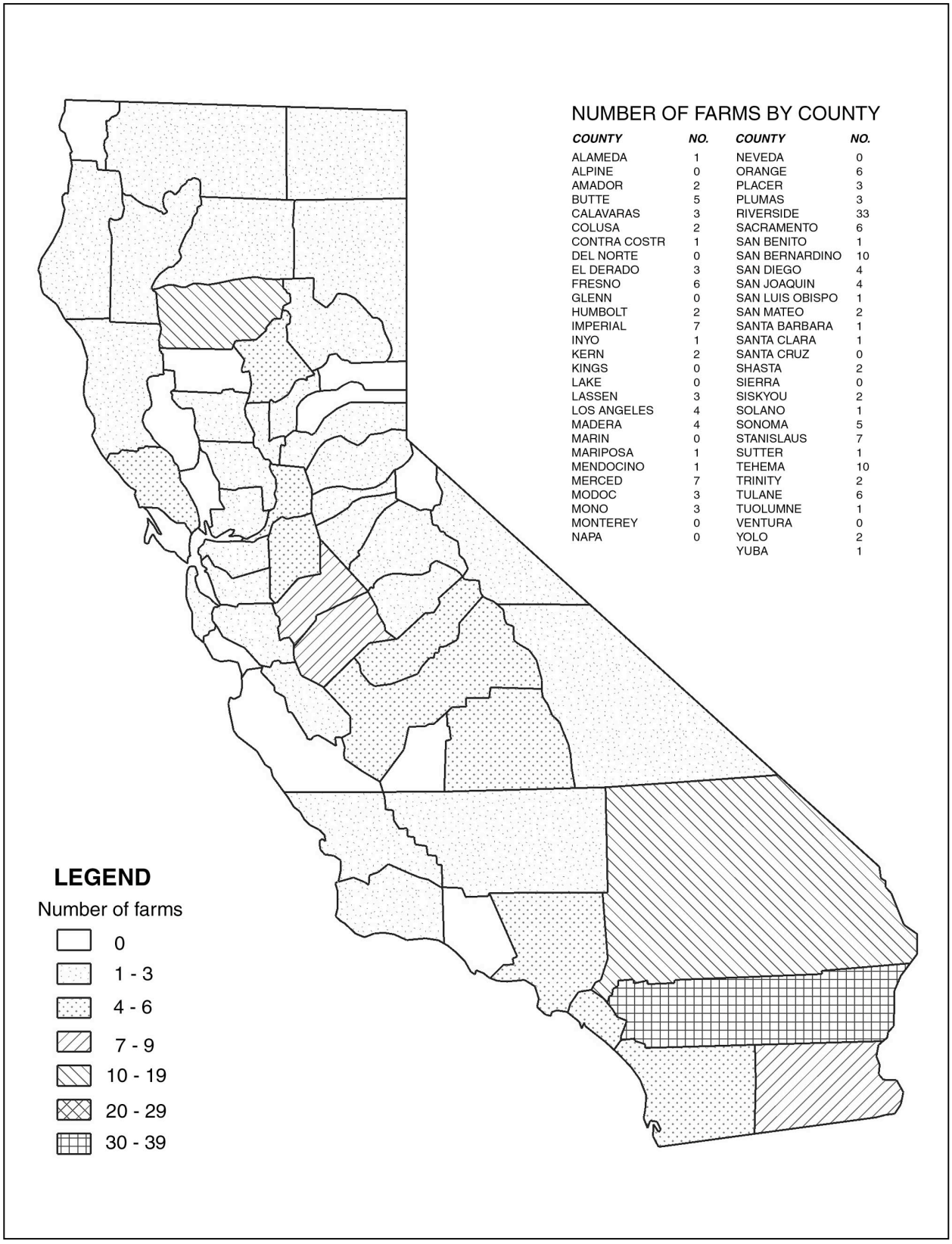

Figure 3-1. Number of freshwater aquaculture facilities by County in California, April 2000.

3.3 METHODS OF FRESHWATER AQUACULTURE PRODUCTION

Based on the physical characteristics of California's inland environment, in conjunction with State codes that govern aquaculture, an existing or proposed inland aquaculture facility in California is likely to use one of the following four methods for production:

- Pond Culture
- Raceways or Tanks
- Recirculating Systems
- In-water Cage Culture

Ponds are the most common method used for inland aquaculture production in California, based on the responses received for the national aquaculture census (USDA 1998). Ponds are the primary method used for the production of warmwater species such as catfish and tilapia; in cooler climates they are also used for species such as trout and juvenile salmon. Pond operations are often characterized as either intensive or extensive. Intensive culture relies on a continuous water supply that flows through the rearing unit, supplemented with artificial feed. Extensive culture uses a limited quantity of water, mostly to account for evaporation or pond leakage or both, and relies on both artificial feed and natural food production within the rearing unit. Natural food production for extensive pond operations may be enhanced via pond fertilization.

Raceways and tanks are generally smaller rearing units, constructed of concrete, fiberglass and metal, and generally having greater flow control and a larger flow rate than ponds. Raceways and tanks are suitable for rearing almost any species under intensive culture methods (Stickney 1986). In California, raceway and tank culture has been commonly used for the production of trout, sturgeon, striped bass, hybrid bass, and ornamentals.

Recirculating systems are typically comprised of several raceway or tank rearing units, but are characterized by the addition of water treatment facilities that allows water reuse and greater productivity when there is limited flow availability. Common products of recirculating systems in California include hybrid striped bass, tilapia and ornamentals.

Cage culture can be used in existing bodies of water that cannot be drained or seined and would otherwise not be suitable for aquaculture. These include lakes, farm ponds, rivers and cooling water discharge canals (McGinty and Rakocy 1990). At present this method is not commonly used for inland aquaculture in California, but in other areas of the U.S. it has been widely used for the production of tilapia, hybrid striped bass, and juvenile salmon.

The operators of inland aquaculture facilities may choose to incorporate the techniques of polyculture (the rearing of two or more compatible species within the same rearing unit) and farm diversification (production of multiple aquatic resources through water reuse). An example of polyculture being conducted in California is the integrated production of catfish and baitfish such as fathead minnows. Farm diversification can be seen at trout production facilities that divert a portion of the effluent from trout raceways into other raceways or shallow ponds used to culture tubificid annelid worms for the aquarium trade. Another diversification venture is the culture of sturgeon and striped bass in tanks using first-pass water , catfish production in ponds using second-pass water, and a final use of the water for land based agriculture. These integrated

aquaculture strategies allow the farm facilities to share resources, produce year-round crops, and expand markets.

3.4 POND CULTURE

3.4.1 Physical Setting

The term "pond" typically refers to a water impoundment unit with limited incoming water flow. Most ponds are earthen and can be a variety of sizes and shapes, dependent upon the function to be performed and species being cultivated (Figure 3-2). Pond size generally ranges from 1/4 acre to 20 acres, although ponds as large as 100 acres have been utilized for growing catfish. In California, catfish are produced on farms ranging from 3 to 400 acres of surface water. Pond shape is typically square or rectangular, but can be most any shape to fit the size and topography of the farm site and to meet the needs of the species being raised. The pond size is determined by the desired final crop size at harvest or transfer to ensure adequate biological carrying capacity.

Figure 3-2. A facility with several earthen ponds. (Courtesy The Fishery)

Pond construction is based on the topography of the farm site and falls into one of three categories: ravine, excavated and levee. A ravine pond is well suited for facilities on hilly landscapes. This type of pond is created by damming up a natural, deep depression. It requires a screened outlet structure to retain fish in the pond while controlling water flow and depth. Disadvantages of this type of pond are potential water quality impacts from surrounding hillside drainage and the risk of potential flooding from stormwater runoff. Conversely, excavated ponds can be constructed on fairly level land that does not flood. The excavated pond is normally constructed to allow complete drainage of the pond for harvest and maintenance. Material excavated during construction can be utilized to build the pond embankments. Levee ponds are also created on flat land and are constructed by flooding the impounded area. Levee ponds should drain completely and independently from adjacent ponds. A vegetative cover on the pond embankments and levees is usually encouraged to help prevent erosion. A harvest basin can be constructed either within the pond or external to the pond to facilitate harvest if the ponds are to be drained for such purposes. External harvest basins are advantageous in that they contain less mud and are thus easily accessible to harvesting equipment.

3.4.2 Operational Setting

Pond structures are utilized in various ways to meet the operational needs of the farm and the rearing requirements of the species. Some functions of pond facilities include holding of broodstock, spawning, early rearing, fingerling grow-out, and catch-out. Holding ponds maintain and condition broodfish before and after spawning. Multiple

small (1/4 acre) ponds are used to protect the broodstock in case of a disease outbreak. Use of multiple ponds may limit such a disease from spreading to all the broodfish on the farm. Spawning ponds are also small structures. The broodfish are placed in the pond or in cages in the pond just prior to spawning and then removed post spawn. Early rearing ponds tend to be small as well, with multiple units on the farm. Fry are placed in these ponds for rearing until they fingerlings. The fingerlings are then moved to grow-out ponds where they grow until reaching the desired harvest size. Grow-out ponds generally range from 1/2 acre to 20 acres in size, though some may be larger. Catch-out ponds are stocked for sportfish harvest. These ponds are typically stocked with a high density of fish to ensure a successful fishing experience. Catch-out ponds may range in size anywhere from 1/4 acre to 20 acres or larger.

Aquatic weed species can be a problem in earthen ponds. For example, excessive plant growth can cause oxygen depletion on hot nights, when plants begin using oxygen instead of producing it. Submerged plants can also cover feeding and nesting areas, making them unusable to fish. Furthermore, ponds with heavy vegetation can be difficult to harvest.

Pond fertilization is practiced in certain industries, such as catfish, ornamental, and baitfish operations. Fertilization helps to generate a suitable food source for the species being reared. First, fertilizers added to the water encourage phytoplankton (microscopic plant organisms) to reproduce. Second, the resulting bloom increases the turbidity of the water (an indicator of the fertility of the pond). Lastly, the phytoplankton are either consumed directly by the fish or by zooplankton (microscopic animals), which is then consumed by the fish.

Ponds are routinely dried up after harvesting to reduce both predators that may have become established in the pond and the presence of infectious disease organisms or parasites. Pond soils may be disinfected with chemicals to eradicate diseases or parasitic organisms. If ponds cannot be completely dried they may be treated with rotenone to remove unwanted fish species prior to restocking. Other agents may be applied to control crayfish or weed species.

A number of harvest methods can be implemented in pond operations. As discussed in the physical setting section, harvest basins are sometimes incorporated into the pond design either within the pond or external to the pond. With or without harvest basins, ponds in California are most often harvested by seining. Seining can be conducted by hand in small ponds or by boat and/or tractor in large ponds. The largest farms, usually producing catfish, generally have harvest ranges from 1,500 to 11,975 pounds per acre.

3.5 RACEWAYS/TANKS

3.5.1 Physical Setting

Figure 3-3. Concrete raceways, with a drain channel along one side. (Courtesy Fish Partners)

Raceways differ in shape depending on the use and topography of the site (Figure 3-3). Most are rectangular to facilitate consistent water flow throughout the rearing unit. Raceways can be constructed from any durable material, although most are made of concrete. Earthen raceways, constructed from heavy clay soils, also exist. Regardless of the material, raceways can be placed in series with water flowing from an upper unit to a lower unit, with re-oxygenation of the water occurring between units. This arrangement of raceways re-uses water efficiently, thereby increasing the amount of product produced for each gallon of water used. However, this method increases the concern for disease transmission and reduced water quality. Raceways can range in size from less than 30 feet to as long as 400 feet. Widths also vary but generally range from 3 to 30 feet. Depths of 1.5 to 5 feet are typical.

Figure 3-4. Circular, above-ground tanks. (Courtesy The Fishery)

Tanks, in contrast, are typically circular (Figure 3-4). They can be constructed of concrete, fiberglass or metal, and typically range in size from 3 to 30 feet in diameter. Circular tanks typically have center drains.

3.5.2 Operational Setting

Raceways are typically used in the trout and salmon industry and have limited usage in the culture of warmwater fishes.

Flow-through raceways require large volumes of high quality water for intensive rearing. Production levels in these units can vary greatly depending upon the species being reared, the available water volume, and water quality. Water flow through the

unit must be at a rate that removes metabolic waste products and meets the oxygen demand of the loading density. Typically, water moves through the rearing unit at a rapid rate, providing new, high-quality water that allows high densities of fish to be reared. If raceways are used in series (as discussed above), rearing densities in the end units may need to be reduced to compensate for reduced water quality.

Circular tanks have a uniform pattern of water circulation that allows fish to distribute themselves throughout the vessel instead of crowding to the head end of a rectangular shaped structure. Tanks with center drain outlets can be nearly self-cleaning. These outlet drains must be properly screened to prevent fish from escaping or being impinged on the screen. When provided with supplemental oxygen, circular tanks generally require less water flow than raceways. Circular ponds are well suited for rearing fish from fry to harvest size.

Feeding in raceways and tanks is typically conducted by hand. Hatchery workers walk the perimeter dispersing feed throughout the rearing area. Feeding by hand allows the hatchery workers to monitor the fish throughout the day to potentially spot disease or culture problems and thus preempt their escalation. Another option involves automated feeders, which consist of a feed hopper and a timing mechanism, that dispense feed at one location in the pond at a pre-set timed interval. Although these feeders can reduce staffing requirements, regular observations of fish may be forfeited. A demand feeder, another form of automated feeder, has a suspended rod that hangs into the water column. When the fish move the rod, feed is released. Fish are quickly trained to these types of feeders. Multiple demand feeders can be located on a rearing unit to provide increased access to food. A large complex of raceways may require truck-mounted blower feeders. These feeders mechanically distribute feed from a hopper, dispersing it over the raceways as the truck is driven along the edge of the raceway. While distributing feed throughout the rearing unit, the driver can observe fish response to the feed, thus gaining some indication of fish health.

Raceways are well suited for chemical flush treatments to treat disease. With the uniform flow throughout the rearing unit the operator can be assured that an accurate treatment is conducted. Tanks can be more difficult to treat due to the water flow pattern created by the center drain and may require a reduced flow bath treatment. Both raceways and tanks can be thoroughly dried and disinfected between crops.

Harvest in raceways and tanks is usually accomplished by reducing the water depth to a suitable working level and then crowding or seining the fish to a concentrated area. Fish can then be removed by hand with dip nets, screen buckets, or fish pumps.

3.6 RECIRCULATING SYSTEMS

3.6.1 Physical Setting

Figure 3-5. The rearing unit area for a closed recirculation system. (Courtesy Kent Sea-Tech)

Recirculating, or closed, systems incorporate water treatment and reconditioning with each pass of water through the hatchery system. Rearing units within a recirculating system can be composed of raceways and tanks (Figure 3-5). A typical facility includes a method for removal of particulate solids, a filter for the removal of metabolic waste products, and a method to replace dissolved oxygen. Some systems may also incorporate ultra-violet or ozone sterilization to control fish pathogens, a chiller/heating unit to control water temperature, or additional water chemistry controls. Figure 3-6 provides an example of a metabolic waste filter at one of the largest recirculation facilities currently in California.

Figure 3-6. A portion of the treatment system used for a closed recirculation system. (Courtesy Kent Sea-Tech)

Three types of filtration methods are available for the removal of ammonia and other metabolic wastes: chemical, mechanical and biological. Chemical filtration involves the removal of waste products at a molecular level by adsorption on a porous substrate or by oxidation. Examples of chemical filtration include ion exchange using natural zeolite, foam fractionation, carbon adsorption, airstripping, breakpoint chlorination and ozonation.

Mechanical filtration involves the removal of suspended particles from the water. Mechanical filtration devices include microstrainers, drum or screen filters, sand filters, and diatomaceous earth filters. Biological filtration (also called biofiltration) is the process of converting nitrogenous compounds from a toxic to a non-toxic form. This process can be either aerobic (nitrification) or anaerobic (denitrification). The aerobic method has the most application in aquaculture industry. The aerobic biofilter is composed of filter beds that provide large amounts of surface area for colonization by bacteria. Typical filter bed materials include clinoptilolite, fiberglass or plastic objects (saddles, beads or rings), oyster shell, sand or rock. The bacteria *Nitrosomonas* sp. converts ammonia to nitrite, then *Nitrobacter* bacteria convert nitrite to non-toxic nitrate. Both ammonia and nitrite can be extremely toxic to fish.

Biofilters need to be properly sized to account for many operational factors including flow rate, waste load, species cultured, start-up conditioning time, biomass loading patterns of the facility, and many others. Adequate temperature, pH, alkalinity, and dissolved oxygen must be maintained for optimum removal of ammonia.

The core of a recirculation system is the filter. Filtration systems often incorporate both mechanical and biological filtration. Small amounts of make-up water (generally at least 10% of system volume) are added to the system. This water is necessary to maintain water quality and fish health, and may be added to account for evaporative loss, to filter condition wasted water, or to clean wasted water. Cleaning wastes are often routed to a pollution abatement pond to separate them from the recirculating process water. Otherwise, these wastes may overload or clog the filters, potentially causing large losses. If self-cleaning rearing units are utilized in the hatchery, a solid waste removal filter, such as a microdrum screen filter, is usually incorporated into the system before the bio-filtration units.

3.6.2 Operational Setting

Recirculating systems are suitable for the production of fish when a limited supply of water is available, or for efficiently re-using water that has been heated or chilled to an optimum rearing temperature. Operational costs of these facilities can be high. Water is constantly pumped through the system, and if cooling towers, chillers or heaters are necessary, power costs can be high. Recirculation systems also require increased monitoring and maintenance, which results in increased labor costs. Alarm and back-up systems are often used to prevent a mechanical failure leading to significant fish mortality.

Biofilters must be conditioned prior to use to allow for adequate colonization of bacteria on the media. Water from biofilters undergoing conditioning should be wasted out of the system since it contains ammonia.

Feeding rates must be carefully applied to minimize wastage that could overwhelm the capacity of the recirculation system. Biofilters must be routinely cleaned to remove accumulated solids. Filters are usually cleaned by removing solids through a process called backwashing. These solids are routed to a pollution abatement facility or collected for disposal.

3.7 CAGES

3.7.1 Physical Setting

Cages are floating structures that are anchored to the bottom of rivers, lakes or ponds. Cage facilities can consist of anywhere from an individual unit to a number of units rafted together with adjoining walkways for worker access (Figure 3-7). Netting material is suspended in the water column and attached to the floating support structure. In areas with strong currents, weights may be placed in the corners of the pen to prevent the netting from collapsing inward. Predator netting may be required both outside the cage and on top of the cage. Cages must be sited in a location that provides sufficient depth below the bottom of the netting to allow adequate water circulation, and that has enough water movement to provide oxygenated water throughout the cage. This method also relies on wind action to move and aerate the water. Because of this, cages are usually placed so that the longer side is perpendicular to the prevailing wind.

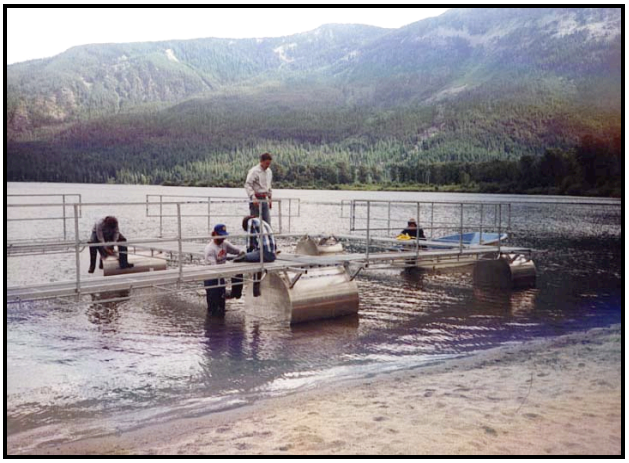

Figure 3-7. Floating cage.

Cages can range from small, 1 cubic yard, to large, 65 feet wide by 35 feet deep. A variety of dimensions can be utilized to meet the needs of the farm as well as meet site-specific constraints.

3.7.2 Operational Setting

Cage culture is well suited to areas where the water cannot be drained or easily harvested and has been successfully used for catfish, trout and salmon. These operations often have associated land-based support facilities.

SECTION 4. PROGRAM ALTERNATIVES AND MITIGATION STRATEGIES

4.1 PROGRAM ALTERNATIVES

Two program alternatives were considered for this PEIR: the No-Project Alternative and the Preferred Alternative.

4.1.1 No-Project Alternative

The No-Project Alternative assumes that no new aquaculture projects will be approved in California, and that the industry will continue at existing facilities and at present levels of production. The No-Project Alternative is used as a basis for comparison to the Preferred Alternative, which would allow continued growth of the industry.

4.1.2 Preferred Alternative

The Preferred Alternative consists of approving new project applications through the current set of regulations governing the aquaculture industry, with a recognition that appropriate site-specific mitigation may be developed in the course of approving discretionary permits for individual projects. Table 4-1 provides a summary of the impact potential for each of the four typical categories of inland aquaculture production, based on a more detailed discussion of impacts presented in Section 5. The table also identifies the permit and regulations that typically establish operational requirements and/or mitigation measures that reduce potential impacts to less-than-significant levels.

The preference for continued growth in the California aquaculture industry is broadly reflected in aquaculture policies of both the California Public Resources Code and the U.S. Department of Commerce (see Section 3.1). Table 4-2 provides a summary of the beneficial impacts of the preferred alternative in comparison to the No-Project Alternative.

4.2 MITIGATION STRATEGIES FOR THE PREFERRED ALTERNATIVE

Because this Program EIR does not evaluate site-specific actions, no specific mitigation measures are presented. Instead, general mitigation strategies are identified that provide ways to avoid, minimize, restore or compensate for potentially significant impacts. Table 4-3 provides a summary of these potentially significant impacts along with associated mitigation strategies that have been used in recent permits for approved aquaculture projects. A more detailed description of these mitigation measures is provided Section 5.

Table 4-1. Impact potential and associated governance for inland aquaculture facilities.

Resource Category (PEIR Section Number)	Impact Potential of Aquaculture Facilities **without** Mitigation or Regulatory Measures Severity of Impact: ○ Low, ◗ Medium, ● High Likelihood of Occurrance: ❑ Low, ▮ Medium, ■ High				Permit or Regulation that Typically Significantly Reduces Severity of Impact and /or Likelihood of Occurrence
	Pond Culture	Raceways and Tanks	Recirculating Systems	Cage Culture	
Aesthetics (5.2)	◗ ▮	◗ ▮	◗ ▮	◗ ▮	Development Permit issued through local government
Agricultural Resources (5.3)	○ ❑	○ ❑	○ ❑	○ ❑	
Air Quality (5.4)	○ ▮	◗ ▮	◗ ▮	○ ❑	Authority to Construct issued by county or regional Air Pollution Control District
Biological Resources (5.5)					
Special Status Species	● ▮	● ▮	● ▮	○ ▮	Local permit or CDFG Streambed Alteration Permit may also trigger review by USFWS or NMFS
Sensitive Habitat	◗ ▮	◗ ▮	◗ ▮	◗ ▮	CDFG Streambed Alteration Permit; USCOE Form 4345
Fish and Wildlife Migration	◗ ▮	◗ ▮	◗ ▮	○ ❑	CDFG Streambed Alteration Permit
Predator Species	◗ ■	◗ ▮	◗ ▮	◗ ▮	Depredation permits issued by USFWS or NMFS
Introduction of Exotic Species	● ▮	● ❑	● ❑	● ▮	CDFG Aquaculture Registration; CDFG Permit for Exotic or Prohibited Species
Disease Transmission	◗ ▮	◗ ❑	◗ ❑	◗ ▮	CDFG Aquaculture Registration; CDFG Importation Permits and Health Certificates
Escapement	● ▮	● ❑	● ❑	● ▮	CDFG Aquaculture Registration
Cultural Resources (5.6)	◗ ▮	◗ ▮	◗ ▮	◗ ❑	Identification of site-specific resources during initial consultation with local government
Geology and Soils (5.7)	◗ ❑	◗ ❑	◗ ❑	○ ❑	Local government review for seismic issues

(continues next page)

Table 4-1. (Cont.)

Resource Category (PEIR Section Number)	Impact Potential of Aquaculture Facilities **without** Mitigation or Regulatory Measures Severity of Impact: ❍ Low, ◗ Medium, ● High Likelihood of Occurrance: ❑ Low, ▮ Medium, ■ High				Permit or Regulation that Typically Significantly Reduces Severity of Impact and /or Likelihood of Occurrence
	Pond Culture	Raceways and Tanks	Recirculating Systems	Cage Culture	
Hazards and Hazardous Materials (5.8)	◗ ❑	◗ ❑	◗ ❑	❍ ❑	Regional Water Quality Control Plans and NPDES permits; USFDA regulations re drug use
Hydrology and Water Quality (5.9)					
Water Supply	❍ ❑	❍ ❑	❍ ❑	❍ ❑	Regional Water Quality Control Plans
Waste Discharges	◗ ▮	◗ ■	❍ ❑	◗ ▮	Regional Water Quality Control Plans and NPDES permit
Stormwater Discharges	◗ ▮	◗ ▮	❍ ❑	❍ ❑	Regional Water Quality Control Plans and NPDES permit
Land Use and Planning (5.10)	◗ ■	◗ ■	◗ ■	◗ ■	Development Permit issued through local government
Mineral Resources (5.11)	◗ ❑	◗ ❑	◗ ❑	❍ ❑	
Noise (5.12)	◗ ▮	◗ ▮	◗ ▮	❍ ❑	Local government ordinances
Population and Housing (5.13)	❍ ❑	❍ ❑	❍ ❑	❍ ❑	
Public Services (5.14)	❍ ❑	❍ ❑	❍ ❑	❍ ❑	
Recreation (5.15)	❍ ❑	❍ ❑	❍ ❑	◗ ▮	Development Permit issued through local government
Transportation and Traffic (5.16)	❍ ❑	❍ ❑	❍ ❑	◗ ▮	
Utilities and Service Systems (5.17)	❍ ❑	❍ ❑	❍ ❑	❍ ❑	
Growth Inducing Impacts (5.18)	❍ ❑	❍ ❑	❍ ❑	❍ ❑	

Table 4-2. Summary of beneficial impacts of the preferred alternative.

Resource Category	Beneficial Impacts
Agricultural Resources	Continued enhancement of aquaculture technologies will promote diversification and subsequently encourage best use of agricultural resources.
Biological Resources	
Fish Migration and Habitat	In-water structures create new habitat for aquatic organisms such as algae, invertebrates, and fish.
Bird Migration and Habitat	Pond culture creates ponds for resting and feeding of migratory waterfowl. Pond edges create habitat for wading bird feeding and nesting.
Special Status Species	Aquaculture is contributing efforts to restoration and enhancement programs for listed species.
Fishery Resources	Availability of aquaculture products may reduce demand for depleted natural fisheries resources, which may help restore and maintain sustainable wild stock fisheries.
Economic and Social Effects	
Agricultural Economics	Enhances agricultural revenues.
Regional Economics	Generally benefits regional economies through employment, often in rural areas.
National Economics	Increases in domestic aquaculture production will help offset the $6 billion annual U.S. trade deficit in seafood.

Table 4-3. Summary of potentially significant adverse impacts and associated potential mitigation measures.

Potentially Significant Adverse Impact (and Nos. of Potential Mitigation Measures)	Potential Mitigation Measures
Potential impact to scenic view or perceived visual character of an area (1) Potential impact to sensitive species or sensitive habitat such as wetland or riparian habitat (2, 3, 4, 5, 9) Potential impact to habitat access and potentially altered flow conditions from stream diversions (3, 4) Potential introduction of exotic species (5, 6) Potential transmission of disease to native populations from aquacultured organisms (5, 6, 7) Potential impact to native populations from competition for food sources and habitat due to escpapement of aquacultured organisms (5, 8) Potential impact to genetic integrity of native populations due to escpapement and interbreeding with aquacultured organisms (5, 8) Potential impact to water quality from facility discharge (10, 11, 12) Short-term increase in turbidity resulting from construction activities (10)	1. Use of visual screening methods such as tree plantings, site layout, or natural coloration in structures 2. Avoidance of locating operations within areas containing sensitive habitat 3. Implementation of a CDFG streambed alteration agreement to assure there is no impact 4. Funding of on-site evaluations to obtain additional information regarding potential impacts and need for mitigation 5. Implementation of special conditions through CDFG review and approval of Aquaculture Registration application 6. Requirement that stock be obtained from disease-free source 7. Treatment of on-site pathogenic events through proscribed doses of approved drugs using protocols that do not impact adjacent wildlife resources 8. Use of secure methods to prevent escapement, including double-hung netting, redundant cage anchors, and effluent screening 9. Limiting construction activities to windows of minimal species vulnerability 10. Implementing BMPs such as stormwater pollution prevention plans, erosion control plans and spill prevention plans 11. Siting of facilities to assure adequate water flow for dispersal of both natural feed and wastes 12. Construction of effluent treatment facilities, such as settling ponds, to ensure compliance with water quality discharge standards

SECTION 5. ENVIRONMENTAL REVIEW

5.1 APPROACH TO ENVIRONMENTAL ASSESSMENT

This chapter of the PEIR analyzes and describes the potential environmental impacts associated with implementation of proposed inland aquaculture projects. The environmental assessment is organized using the same 16 resource categories defined in the Environmental Checklist presented in the 1998 amendment of the CEQA Guidelines. Within each section (addressing an individual resource category), the questions contained in the Environmental Checklist are provided first, followed by a discussion of the environmental setting, the regulatory framework, and the potential environmental impacts and associated recommended mitigation measures. The checklist prompts the reviewer to examine a spectrum of activities that potentially could result in significant environmental effects if they were to occur with the project. It is important to note, however, that the checklist does **not** represent an all-inclusive list of potentially significant environmental effects, and this PEIR addresses additional activities not identified on the checklist that are common in the aquaculture industry.

A key aspect of the CEQA analysis is determining whether or not an activity may result in a significant adverse environmental effect. CEQA regulations purposefully do not define specific thresholds of significance, because the significance of an activity may vary with the setting. Instead, CEQA regulations authorize and encourage local governments to adopt thresholds that most appropriately reflect local and agency policies. A threshold of significance can be defined as a quantitative or qualitative standard, or set of criteria, pursuant to which the significance of a given environmental effect may be determined. A threshold may be based on standards such as the following (GOPR 1994):

- A health-based standard such as water pollutant discharge standards, air pollutant emission standards, or noise levels.
- Service capacity standards such as traffic level of service, water supply capacity, or waste treatment plant capacity.
- Ecological tolerance standards such as physical carrying capacity, impacts on declared threatened or endangered species, or wetland encroachment.

It is the intent of the California Environmental Quality Act (CEQA) to focus on significant adverse effects. Therefore, mitigation is only required when significant adverse effects are anticipated. Wherever possible, this PEIR identifies specific thresholds that have been used in the programmatic determination of significance. The PEIR subsequently identifies mitigation measures that might be useful in reducing the adverse effects to levels that are less than the threshold of significance for each issue described.

Programmatic characteristics of the inland aquaculture industry suggest the potential

for significant adverse effects is greatest in two resource categories: Biological Resources and Hydrology and Water Quality. As a means to provide a concise summary of the issues that may occur in these two resource categories, the environmental impacts discussion for these categories conclude with a table itemizing the issues, the thresholds of significance used in the analysis of effects, and the associated mitigation measures that ensure an adequate reduction of impacts. The table indicates that, in many cases, these thresholds of significance will be based on local regulation, and/or they will require site-specific evaluation at the individual project level. Mitigation plans developed for individual inland aquaculture projects, where necessary, will take into account specific relevant characteristics of the proposed individual project, such as the production level, water supply requirements, or the presence of sensitive habitat.

5.2 AESTHETICS

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☒	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☒	☐

5.2.1 Environmental Setting

Aesthetics typically refers to the perceived visual character of an area, such as the scenic view, open space, or architectural facade. The physical characteristics of a landscape determine its scenic quality and its relevant value to the viewing public. These characteristics can be of both natural and manmade features. Natural features include water, landform, vegetation, and soils. Manmade features include physical structures, roads, and so on. Since scenic quality is an element of human sensory experience, the most important visual resources are those within the view of both existing and potential areas accessible to people (roadways, rivers, trails, recreation sites, and human developments). The focus of attention is on unusual and high-quality visual resources, such as scenic vistas, mountainous terrain, steep slopes, natural drainages and waterways, interesting patterns of vegetation, and rock formations, that play a dominant role in characterizing a particular scene in the context of the surrounding landscape.

The aesthetics of California's inland areas vary widely. Mountains, foothills, forests, lakes, agricultural lands, grasslands, and deserts are some of the various landscape types that can present scenic views and open space. Some of California's greatest aesthetic resources can be viewed at more than 280 units maintained by California State Parks and the National Park Service.

5.2.2 Regulatory Framework

Every City and County in California has an adopted general plan that sets forth policies to guide local land development. Scenic resources are typically addressed in the open-space element of the local general plan. The open-space element depicts:

- Areas of outstanding scenic, historic and cultural value.
- Areas particularly suited for park and recreation purposes, including access to lake shores, beaches, and rivers and streams.
- Areas which serve as links between major recreation and open-space reservations, including utility easements, banks of rivers and streams, trails, and scenic highway corridors.

The open-space element of each general plan should also define any programs for protecting and promoting scenic viewsheds and scenic values. When reviewing local development applications, local governments will consider the visual impacts associated with aquaculture facilities and determine the project's consistency with programs for protecting scenic resources.

5.2.3 Environmental Impacts

The process requirements of inland aquaculture include the need for water and ample land, similar to the needs of the agriculture industry. The nature of the product requires easy access to markets or processors. As a result, most inland aquaculture projects are located in agricultural or rural landscapes, within relatively close proximity of urban markets.

The most common methods of freshwater aquaculture in California are pond culture, raceways/tanks, and recirculation systems. Pond culture consists of water impoundment units that are typically earthen. Pond construction is based on the topography of the proposed project site. Hilly landscapes are well-suited for ravine ponds that are created by damming up natural deep depressions. More commonly, ponds are excavated or levee ponds created on relatively flat lands. The construction of ponds involves earth-moving operations and may result in recontouring of the natural landscape. These actions are not uncommon in agricultural areas, and normally this would represent a less than significant visual impact. However, final determination could not be made until review at the individual project level.

Raceways and tanks are usually built wholly or partially above the finish grade surface, and they vary in size. Raceways typically are constructed from concrete or heavy clay soils. They range in size from 30 to 400 ft in length, 3 to 30 ft in width, and 1.5 to 5 ft in height. Tanks are typically constructed of concrete, fiberglass or metal and range in size from 3 to 30 ft in diameter and 2.5 to 6 ft in height.

Recirculating systems are typically integrated into raceway or tank culture operations and therefore are similar in appearance. As with pond culture, these types of structures are consistent with the agricultural setting in which most aquaculture facilities are located, producing a less than significant visual impact.

Cages are floating structures that are anchored to the bottom or shoreline of rivers, lakes, or ponds. While not commonly used in inland aquaculture in California at this time, the culture method has potential for industry expansion. Cage facilities can

consist of anywhere from an individual unit to a number of units rafted together with adjoining walkways for worker access. Walkways and cage tops are above the surface and would be visible. Based on the typical agricultural setting of most aquaculture facilities, normally this would present a less than significant impact, though final determination could only be made at the individual project level.

All four of the freshwater aquaculture methods could potentially contrast with existing landscapes. In cases where the surrounding landscape is of special scenic value, there are mitigation measures that could be implemented to reduce the visual impact of the proposed facilities. Examples of mitigation include:

- Limiting the height of structures below an established standard to reduce the vertical profile of a project.
- Use of construction materials that have a coloration consistent with the natural background.
- Use of tree plantings or other landscaping methods to provide a visual screen of facilities.
- Use of natural-colored shade cloth or fencing materials to conceal visible structures.
- Enhancement of visually degraded areas located on the site, such as the removal of abandoned facilities.

The extent to which a freshwater aquaculture facility may have a substantial adverse effect on a scenic vista, substantially damage scenic resources, and/or substantially degrade the existing visual character or quality of a site and its surroundings, is based on site-specific characteristics. Because proposed projects will most often be located in an agricultural area and are comprised of facilities that are consistent with this setting, the visual impact of these facilities normally will be less than significant. Where necessary, the project proponent will coordinate with local permitting agencies to establish mitigation measures that will reduce visual impacts and assure compliance with the appropriate general plan.

5.3 AGRICULTURAL RESOURCES

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	☐	☐	☐	☒

5.3.1 Environmental Setting

California is the nation's leading agricultural state, with $26.8 billion worth of total production and income in 1997 (California Department of Food and Agriculture 1997). The variety of climates and soils in the state, together with the long growing season and availability of water, make it suitable for growing a wide variety of crops. The major crops produced include asparagus, cotton, citrus, grapes, lettuce, nuts, stone fruits (e.g., almonds and plums), strawberries, and tomatoes. Poultry, dairy, and beef cattle are also important products.

The commercial aquaculture industry is a form of agriculture present throughout California, producing a wide variety of aquatic plants and animals in salt water, brackish water and fresh water. Recent estimates of the wholesale value of California aquaculture production range from a low of $45 million reported in the 1998 national census (USDA 1998), to a midrange value of $71 million reported for 1997 by the Western Regional Aquaculture Center (Toba and Chew 1999), to a high of $83 million reported for 1998 by the California Aquaculture Association (CAA 1999). In April 2000 there were 220 existing registered aquaculture facilities in the state, with 176 of these facilities (80%) being freshwater projects in nearly every county. A listing of the

freshwater products most commonly marketed at present is noted below, along with other products produced in California in recent years.

Commonly Produced Products	*Other Products*	
Algae	Black bass	Salmon (juveniles)
Catfish	Carp	Sunfish/Bluegill
Striped/hybrid bass	Koi/Goldfish	Crayfish
Tilapia	Minnows	Prawns
Sturgeon	Mosquito Fish	Aquatic plants
Trout	Ornamental fish	Frogs
	Sacramento blackfish	Worms, tubifex

5.3.2 Regulatory Framework

Agriculture is one of the most important industries in California and a number of laws and regulations have been implemented to help preserve agricultural lands throughout the state. The most important law that could potentially affect freshwater aquaculture programs is the Williamson Act.

The Land Conservation Act, or Williamson Act, applies to lands and is typically regarded as a means to limit the uses of specific private lands to farming and ranching uses over medium-term periods of time. The originators of the Act envisioned a means for local governments to integrate the protection of open space and agricultural resources into their overall strategies for planning urban growth patterns. The three principal objectives were originally:

- Protection of agricultural resources,
- Preservation of open space land, and
- Promotion of efficient urban growth patterns.

The Williamson Act allows local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. In return, landowners receive lower property taxes. Local governments receive an annual subvention of forgone property tax revenues from the State via the Open Space Subvention Act of 1971.

Local agricultural resources are typically identified in the land use and conservation elements of local general plans. General plans identify land within agricultural preserves and identification of land subject to Williamson Act contracts, or in other land conservation programs. The U.S. Natural Resources Conservation Services Land Capability Classification System also identifies prime agriculture land, as does the California Department of Conservation under the Farmland Mapping and Monitoring Program. There are eight classifications as listed below.

- Prime Farmland: Farmland with the best combination of physical and chemical features able to sustain long term production of agricultural crops. This land has the

soil quality, growing season, and moisture supply needed to produce sustained high yields. The land must have been used for the production of irrigated crops at some time during the two update cycles prior to the mapping date.

- Farmland of Statewide Importance: Farmland similar to "Prime Farmland," but with minor shortcomings, such as greater slopes, or with less ability to hold and store moisture. The land must have been used for the production of irrigated crops at some time during the two update cycles prior to the mapping date.
- Unique Farmland: Farmland of lesser quality soils used for the production of the state's leading agricultural crops. This land is usually irrigated, but may include non-irrigated orchards or vineyards as found in some climatic zones in California. The land must have been cropped at some time during the two update cycles prior to the mapping date.
- Farmland of Local Importance: Land, of importance to the local economy, as defined by each county's local advisory committee and adopted by its Board of Supervisors. Farmland of Local Importance is either currently producing, or has the capability of production, but does not meet the criteria of Prime Farmland, Farmland of Statewide Importance, or Unique Farmland. Authority to adopt or to recommend changes to the category of Farmland of Local Importance rests with the Board of Supervisors in each county.
- Grazing Land: Land on which the existing vegetation is suited to the grazing of livestock. This category is used only in California and was developed in cooperation with the California Cattlemen's Association, the University of California Cooperative Extension Service, and other groups interested in knowing the extent of grazing activities. The minimum mapping unit for Grazing Land is 40 acres.
- Urban and Built-Up Land: Land occupied by structures with a building density of at least one unit to one and one-half acres, or approximately six structures to a ten-acre parcel.
- Land Committed to Nonagricultural Use: Land that is permanently committed by local elected officials to nonagricultural development by virtue of decisions which cannot be reversed simply by a majority vote of a city council or county board of supervisors. "Land Committed to Nonagricultural Use" must be designated in an adopted local general plan for future nonagricultural development. The resulting development must meet the requirements of "Urban and Built-Up Land" or "Other Land." County boards of supervisors and city councils have the final authority to designate lands in this category.
- Water: Water areas with an extent of at least 40 acres.

Various California code sections (e.g. Public Resources Code Section 30100-2 and Fish and Game Code Section 17) establish aquaculture as a form of agriculture. Food and Agriculture Code Section 23.5 states:

"The commercial production of fish propagated and raised by a registered aquaculturist

pursuant to Section 15101 of the Fish and Game Code in the state is a growing industry and provides a healthful and nutritious food product, and, as a commercial operation, utilizes management, land, water, and feed as do other agricultural enterprises. Therefore, the commercial production of that fish and marine life shall be considered a branch of the agricultural industry of the state for the purposes of any law which provides for the benefit or protection of the agricultural industry of the state except those laws relating to plant quarantine or pest control."

5.3.3 Environmental Impacts

AQUACULTURE IS CONSIDERED BY CODE TO BE A BRANCH OF THE AGRICULTURE INDUSTRY. PROPOSED PROJECTS INVOLVING AN INLAND AQUACULTURE FACILITY WILL THEREFORE HAVE A DESIGNATED AGRICULTURAL USE AND CONSEQUENTLY SHOULD HAVE NO ADVERSE IMPACT ON THE AGRICULTURAL RESOURCES OF THE STATE. CONSTRUCTION AND IMPLEMENTATION OF INLAND AQUACULTURE PROJECTS A) WILL NOT CONVERT PRIME FARMLAND, UNIQUE FARMLAND, OR FARMLAND OF STATEWIDE IMPORTANCE; B) WILL NOT CONFLICT WITH EXISTING ZONING FOR AGRICULTURAL USE, OR A WILLIAMSON ACT CONTRACT; AND C) WILL NOT INVOLVE OTHER CHANGES IN THE EXISTING ENVIRONMENT WHICH, DUE TO THE NATURE OF AQUACULTURE, WILL RESULT IN A CONVERSION TO NON-AGRICULTURAL USE. THEREFORE, NO IMPACTS WILL OCCUR.

5.4 AIR QUALITY

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the proposal:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☒	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable Federal or State ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☒	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☒	☐	☐

5.4.1 Environmental Setting

The strong influence of the Pacific Ocean, the Coastal Range, the Sierra Nevada and the Cascade Range provide climatic variations in California that run in a general west-to-east direction. California's climate varies from Mediterranean (coastally and most of the state) to steppe (scattered foothills areas) to alpine (high Sierra and Cascade).

The Sierra Nevada and Cascade Range act as barriers to the passage of air masses. In summer, California is protected from much of the hot, dry air masses that develop over the central United States. Because of this barrier and its western border with the Pacific Ocean, portions of the state have a generally milder summer climate than other parts of the country. Summers are characterized by dry, sunny conditions with infrequent rainfall. In the winter, the Sierra Nevada and Cascade Range block cold, dry air masses located in the interior of the United States from moving into California. Consequently, winters in California are milder than would be expected at these latitudes. During winter, inversions can cause the buildup of carbon monoxide and particulates. These barriers often lead to stagnant atmospheric conditions that can cause the formation of smog.

Atmospheric and topographic conditions that create temperature inversions and permit

stagnant air masses to remain for long periods allow the concentration of pollutants to increase. This aggravates pollutant concentration over urban, industrial, and agricultural areas. Air pollution in California is occasionally aggravated by its daily and seasonal wind patterns. Sea breezes move air pollution inland from coastal areas during the day, as cold dense air moves onshore. Land breezes push pollution back to coastal areas during the night.

5.4.2 Regulatory Framework

5.4.2.1 Air Quality Standards

The USEPA has set national ambient air quality standards (NAAQS) for ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, respirable particulate matter (PM10), and airborne lead. An area where the NAAQS for a pollutant is exceeded is considered a nonattainment area and is subject to planning and pollution control requirements that are more stringent than normal requirements.

In addition to the NAAQS, the California Air Resources Board (CARB) has established State Ambient Air Quality Standards (SAAQS) to protect public health and welfare. Standards have been set for ozone, sulfur dioxide, PM10, sulfates, airborne lead, hydrogen sulfide, and vinyl chloride at levels designed to protect the most sensitive members of the population, particularly children, the elderly, and people who suffer from lung or heart diseases. The CARB is responsible for control program oversight activities, while regional air pollution control districts are responsible for air quality planning and enforcement. In addition, the CARB is responsible for assigning air basin attainment and non-attainment designations with respect to the State air quality standards based on the criteria adopted by the CARB and contained in Title 17 of the California Code of Regulations. Air basins are designated as being in attainment if the levels of a criteria air pollutant meet the SAAQS for the pollutant, and are designated as being in non-attainment if the level of a criteria air pollutant is higher than the SAAQs. Therefore, an air basin may have acceptable levels of one criteria air pollutant but unacceptable levels of one or more other criteria air pollutants, and can be both in attainment and non-attainment at the same time.

State and national air quality standards consist of two parts: an allowable concentration of a pollutant and an averaging time over which the concentration is to be measured. The allowable concentrations are based on the results of studies of the effects of the pollutants on human health, crops and vegetation, and, in some cases, damage to paint and other materials. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposures to a high concentration for a short time (e.g., 1 hour), or to a relatively lower average concentration over a longer period (e.g., 8 hours, 24 hours, or 1 month). For some pollutants, there is more than one air quality standard, reflecting both its short-term and long-term effects.

5.4.2.2 Permitting Process

Any person or public entity proposing to construct, modify, or operate a facility or equipment that may emit pollutants from a stationary source into the atmosphere must obtain an Authority to Construct from the county or regional air pollution control district (APCD) or air quality management district (AQMD). Air districts issue permits and monitor new and modified sources of air pollution to ensure compliance with Federal, State, and local emission standards. Each air district determines which emission sources and levels have significant impacts on air quality and, therefore, are exempt from permit requirements. Local air districts also determine appropriate best available technology that must be applied to specific equipment, and/or other mitigation measures that must be applied.

5.4.3 Environmental Impacts

Stationary sources of air emissions at inland aquaculture facilities could include equipment such as water supply pumps and treatment equipment, and back-up power generators to maintain power to the essential equipment during power outages. Back-up power generators are usually fueled by diesel, though propane is used on some occasions. Power generators require air permits from the local air districts and would therefore be required to implement appropriate mitigation to ensure compliance with Federal and State air standards. With the implementation of mitigation required by the local air districts, impacts would be reduced to less than significant.

Other minor sources of emissions could come from trucks and other vehicles used to service the facilities. Truck use on land-based facilities typically involves driving by the rearing units two times per day with the feed trucks; periodic deliveries to and from the site for feed, supplies, and product; and periodic operations and maintenance activities such as pond harvest, fish transfers, and lawn maintenance. The contribution of air emissions from the limited use of these trucks is not considered to be significant.

Aquaculture facilities in general do not result in the generation of odor. An exception could be associated with facilities where odors could occur if routine maintenance (such as cleaning up spilled feed or proper disposal of fish carcasses) were not performed. The significance would depend on the location of sensitive resources (people) and whether they consider the odor to be objectionable. Odors are typically identified by nuisance complaints to the local air districts. Should poor maintenance create objectionable odors affecting a substantial number of people, the appropriate local air district could require the facility to mitigate the problem (for example by requiring that carcasses be buried or otherwise treated or removed from the facility) or stop operations. This impact is therefore considered to be less than significant with appropriate mitigation.

5.5 BIOLOGICAL RESOURCES

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Dept. of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Dept. of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
c) Have a substantial adverse effect on Federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☒	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites?	☐	☐	☒	☐
e) Conflict with any local policies or ordinances protecting biological resources such as a tree preservation policy or ordinance?	☐	☐	☒	☐
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan?	☐	☒	☐	☐

5.5.1 Environmental Setting

Inland aquaculture projects may be located wherever there is a suitable fresh water supply and adequate space on which to site the facilities. The 176 existing freshwater aquaculture projects in California are distributed throughout the state, with industry representation in nearly every county. This wide distribution encompasses all ecological regions that occur within the state, except for the marine regions which provide the setting for coastal marine aquaculture projects. The following paragraphs provide a brief overview of the biological resources that occur within the inland regions of California, citing first the vegetation and wildlife resources and secondly the fish and aquatic resources of the areas.

5.5.1.1 Vegetation and Wildlife

California contains some of the most varied terrestrial habitats and highest biodiversity anywhere on earth. The terrestrial vascular flora of California are estimated to contain more than 5,000 native species, over one-third of which are found nowhere else on Earth, and 1,000 introduced species (CERES 1999). There are 675 species of amphibians, reptiles, birds and mammals known to occur in the state (CDFG 2001).

Populations of plant and wildlife species are of great importance to the state's economy, as agricultural or harvestable crops and as the focal point of recreational activities such as hunting, hiking and camping. There is growing recognition that the health, and hence the value, of these plant and wildlife populations is dependent on proper functioning of the ecological processes that create and maintain habitat. The ecological functions provided by wetlands and riparian communities have been found to be especially significant in their contribution to the health of habitat types well outside of their own borders.

Wetlands are the transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is often covered by shallow water during some parts of the year. In general, wetlands are divided into three categories (CERES 1995):

- saltwater and brackish water marshes, which are usually located in coastal areas;
- freshwater wetlands, which are primarily in the inland areas of California; and
- freshwater forested and scrub wetlands, which are commonly referred to as riparian habitat.

Inland freshwater wetlands can be subdivided into freshwater marshes, vernal pools, and bogs. Freshwater marshes occur in ponds and slow moving streams. They are vegetated mostly with herbaceous plants, predominantly cattails, and species of sedges, and rushes. Freshwater marshes have mineral soils with relatively low fertility. Vernal pools are most often found in grassland communities. They occur in small depressions underlain by dense, impenetrable claypan soils that allow water to accumulate in winter and spring. The pools support small, usually annual plants, which flower as the water in the pools begin to evaporate. Bogs have detrital soils composed of peat, and are vegetated mostly with mosses (CERES 1999).

Riparian wetlands occur on the banks of streams, rivers, and lakes. They commonly feature woody vegetation such as red alder , wax myrtle, cottonwood and willow. An entangling understory of shrubs, flowering plants, and vines provides sites for nesting, shelter and shade for many animals. Common inhabitants include frogs, salamanders, snakes, muskrats, beavers, river otters, and large numbers of resident and migratory birds. Insects thrive and in turn provide an abundant food source to other invertebrates, fish, and wildlife (CERES 1999).

The importance of these wetland and riparian communities is reflected in the following list describing their multiple values and functions (CERES 1995):

- Biological diversity: wetlands provide important habitat for diverse communities of plants and animals, including over 50 percent of the federally listed threatened or endangered species.

- Waterfowl habitat: wetlands provide the principal habitat for migratory waterfowl. California provides critical wintering habitat for millions of waterfowl migrating along the Pacific Flyway, which extends from Canada to Mexico.
- Fisheries: wetlands provide direct spawning and rearing habitats and food supply that supports both freshwater and marine fisheries.
- Flood control: wetlands detain flood flows, reducing the size and destructiveness of floods.
- Water quality: wetlands absorb and filter pollutants that could otherwise degrade ground water or the water quality of rivers, lakes and estuaries.
- Recreation: wetlands support a multi-million-dollar fishing, hunting, and outdoor recreation industry nationwide.

5.5.1.2 Fisheries and Aquatic Organisms

The vast array of rivers, streams and lakes within California supports many important aquatic biological communities and individual species. California fish populations include several native and non-native species. The 67 native fish species exhibit an enormous diversity of form and function, representing an evolutionary response to the variable and often harsh aquatic environments of the state. They live in habitats ranging from desert springs, to rivers that have huge fluctuations in flow, to high mountain streams, to shallow alkaline lakes, to salty estuaries (Veirs et al. 1998, Doyle 1997). Reservoirs developed throughout California in the past hundred years have been frequently managed to support sport fisheries. These fisheries often include non-native fish species such as largemouth bass, spotted bass, red-ear sunfish, crappie and catfish (CALFED 2000).

5.5.2 Regulatory Framework

A number of State, Federal and local regulations determine the extent that development can impact biological resources of the State. The regulations most applicable to the inland environment and its relevant biological resources are summarized below.

California Fish and Game Code. Numerous sections of the Fish and Game Code provide authority to the Commission, and in certain cases to the Department, for protection of the State's fisheries and wildlife. The Commission delegates additional authority to the Department through Sections of Title 14, CCR. Through application of regulations that apply to all facilities required to obtain an Aquaculture Registration, the Department provides review of numerous biological activities such as importation of species, use of exotic species, broodstock collection, disease control and predator control. In addition, Section 1600 (F&G Code) requires a project proponent to develop a Streambed Alteration Agreement with CDFG prior to conducting activities that would affect the bed, bank, channel, or associated vegetation of a designated river, stream or lake in the State of California.

Federal Endangered Species Act (Federal ESA). The Federal ESA is a means to conserve ecosystems upon which endangered and threatened species depend, provide species conservation programs, and achieve the purposes of international treaties. The "take" of species designated as threatened or endangered by National Marine Fisheries Service (NMFS) or U.S. Fish and Wildlife Service (USFWS) is prohibited under the ESA.

"Take" can include harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in such conduct. To prevent take, Federal and State agencies and private interests are required to consult with NMFS or USFWS on actions that may affect threatened and endangered species.

California Endangered Species Act (California ESA). The California ESA exists to conserve, protect, restore, and enhance endangered or threatened species and their habitats. As in the Federal ESA, the California ESA prohibits the take of a species listed as threatened or endangered, including activities that hunt, pursue, catch, capture, kill, or attempt to hunt, pursue, catch, capture, or kill a listed species. The California ESA requires agencies and private interests to consult with CDFG prior to conducting activities potentially resulting in take of a listed species.

Clean Water Act. The Clean Water Act serves to protect and preserve the chemical, physical, and biological integrity of the nation's waters. Several agencies administer the act, including the USEPA, the COE, the State Water Resources Control Board (SWRCB) and its respective Regional Water Quality Control Boards (RWQCBs). Activities that result in the placement of fill material in waters of the U.S. or adjacent wetlands are subject to the jurisdiction of the COE, pursuant to Section 404 of the Clean Water Act, and require authorization prior to project implementation. Individual projects that may affect these jurisdictional waters and wetlands will be subject to permitting at that time.

5.5.3 Environmental Impacts

Inland aquaculture facilities have the potential to impact surrounding biological resources, but with appropriate design and mitigation these facilities can operate with no significant impacts. Areas of potential impact discussed in the following subsections include 1) special status species, 2) sensitive habitat, 3) fish migration, 4) predator species, 5) introduction of exotic species, 6) disease transmission, 7) escapement, and 8) sustainability of fish meal.

5.5.3.1 Special Status Species

Aquaculture operations or construction activities have potential to affect listed species protected under the Federal ESA and the California ESA. A determination of the presence or absence of specific special status species is not possible in a Program EIR and requires review in the context of a site-specific project application. Special status species whose habitat is most likely to overlap with the general requirements of inland aquaculture projects include:

- salmonid species,
- wetland and vernal pool plant species, and
- wetland and vernal pool aquatic species.

Twenty-six population groups of salmonids are currently listed as threatened or endangered under the Federal ESA. These groups are defined as "evolutionary significant units" (ESUs), with each being a distinctive population of salmon or steelhead that is uniquely adapted to a particular area or environment. The 10 listed ESUs that occur in California are:

- Northern California steelhead
- Central California Coastal steelhead,
- South-Central California Coastal steelhead

- California Central Valley steelhead
- Southern California steelhead
- Sacramento River Winter-run chinook
- Central Valley Spring-run chinook
- California Coastal chinook
- Southern Oregon/Northern California Coastal coho
- Central California coho

The geographic range of each ESU has been defined by the National Marine Fisheries Service (NMFS) and includes both the freshwater and marine habitat utilized by these species. Under Section 7 of the ESA, any activity involving Federal funding, permitting or implementation was required to assure that no listed species would be killed or injured without specific authorization. In June 2000, NMFS adopted new rules under Section 4(d) of the ESA , expanding the requirement for protection of these fish to private and State actions as well as Federal actions. These rules are commonly referred to as "the 4(d) rules". Additionally, the 4(d) rules are working towards simplifying the process of project approval by encouraging the development of local regulations assuring "salmon-safe" development. In this way, compliance with local regulations will also mean compliance with the ESA. During the Preliminary Review phase of an individual project application, the local agency will identify whether a proposed site is located within the boundaries of a specific ESU, and it will also provide information regarding the status of local ordinances and plans that pertain to the 4(d) rules.

Proposed development of individual inland aquaculture projects may involve the development of a surface water intake and/or outfall structure, which often occurs within riparian habitat. If the proposed site layout indicates a disturbance to areas that potentially contain salmonid habitat, wetlands, or other rare natural communities, then it is likely that the project proponent will be requested to conduct surveys to identify wetlands and/or rare, threatened and endangered plants and animals during the Preliminary Review phase of an individual project application. The authority for requiring the surveys could come through a relevant Natural Community Conservation Plan or Habitat Conservation Plan, through the General Plan of the local agency, or through the permit requirements of a CDFG Streambed Alteration Agreement, where applicable.

The results of wetlands and species surveys may trigger subsequent permit actions through the NMFS, USFWS, or CDFG, depending on the species identified. Project approval will require a determination of no significant adverse effects on special status species. This determination typically involves analysis of potential impacts to sensitive habitats, fish migration, and other biological parameters that are addressed in the following subsections. As a result, there is no direct discussion of possible mitigation measures to reduce impact on special status species, but it is instead addressed through the separate analyses of other parameters that contribute to a healthy ecosystem function. A project cannot be approved unless potential impacts on special status species are less than significant as required for compliance with ESA policy.

5.5.3.2 Sensitive Habitats

Sensitive habitats are recognized as having special ecological significance to biological resources. The presence of a sensitive habitat can be determined only at the individual

project level. However, based on typical location and operational practices of inland aquaculture facilities, the types of sensitive habitat most likely to be encountered are:

- wetlands and riparian habitat
- benthic communities located on the river or lake bottom at proposed cage culture facilities.

The following paragraphs provide a more detailed discussion of these sensitive habitats and the typical manner in which impacts are avoided or mitigated during the design and permitting stages of an individual aquaculture project.

5.5.3.2.1 Wetlands and Riparian Habitat

Land-based aquaculture facilities may contain areas within their property boundaries that are designated wetlands or riparian habitat. The placement of fill material within wetland boundaries has the potential to alter the water regime and subsequently destroy the wetland. Projects that result in the removal or disturbance of riparian habitat can have substantial erosion impacts on the adjacent aquatic resources.

The most effective approach in avoiding wetlands issues is to avoid any development in potential wetlands areas. Local governmental agencies, assisted by the California Wetlands Information System maintained by CDFG, can assist a project proponent in assessing the general risk as to whether a specific parcel contains designated wetlands or riparian habitat. When it is unknown if these habitats occur on the site, and the project has the potential to affect natural vegetation, then CDFG generally recommends that the project proponent conduct a wetland delineation and/or botanical field survey (CDFG 2000).

The extent of a wetland is determined by examining the presence of three parameters: hydrophitic vegetation, hydric soils, and wetland hydrology. Under normal circumstances, all three parameters must be satisfied for an area to be considered a jurisdictional wetland under Section 404 of the federal Clean Water Act. Only one parameter must be present to qualify as a wetland under the criteria of CDFG.

Hydrophitic vegetation is defined as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present. The vegetation occurring in a wetland may consist of more than one plant community (wetland plant communities may contain plant species that are Obligate (OBL), Facultative Wetland (FACW), Facultative (FAC), Facultative Upland (FACU), Upland (UPL), No Indicator (NI), and/or Not Listed (NL)).

Hydric soils are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part (Experimental Laboratory 1987).

Wetland hydrology is defined as all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. Areas with evident characteristics of wetland hydrology are those where the presence of water has an overriding influence on characteristics of vegetation and soils due to anaerobic and reducing conditions, respectively.

- landscape position and surface topography (e.g. position of the site relative to an

upslope water source, location within a distinct wetland drainage pattern, or concave surface topography);

- inundation or saturation for a long duration (either inferred based on field indicators or observed during field surveys); and
- residual evidence of ponding or flooding (e.g. scour marks, sediment deposits, algal matting, and drift lines).

If it is determined there are jurisdictional wetlands on the site, the project proponent can mitigate potential impacts by avoiding any development within the wetland boundary. If it is not possible to avoid the wetland altogether, it may be possible to adjust component locations to reduce and minimize the area of disturbed wetland. Any individual project proposing the placement of fill in wetlands or below the ordinary high water mark of a riparian zone must obtain an approved Form 4345, administered by the COE through Section 404 of the Clean Water Act. For any work planned within a streambed, a Streambed Alteration Agreement must be obtained from CDFG in accordance with Section 1600 of the Fish and Game Code. The total area of disturbed wetland is a critical parameter in establishing subsequent permit conditions.

Current policy of both the federal and state governments calls for "no net loss of wetlands". Methods of wetlands mitigation that have been accepted by COE and CDFG for other projects include the following.

- For every acre of wetland area affected, an equal area of wetland will be constructed on site.
- For every acre of vernal pool habitat directly or indirectly affected, at least two vernal pool credits will be dedicated with a USFWS-approved ecosystem preservation bank.
- For every acre of vernal pool habitat directly or indirectly affected, at least one vernal pool creation credit will be dedicated within a USFWS-approved habitat mitigation bank.
- For every acre of seasonal swale directly affected, one acre of seasonal swale credit will be purchased from a USFWS-approved habitat mitigation bank.

Additional mitigation measures can be incorporated into individual projects to reduce potential construction activity impacts to less than significant with mitigation. Common mitigation measures include the following:

- During construction, protective silt fences shall be placed 100 feet from any waterway's edge, including wetlands and vernal pools. No construction activity or equipment storage will be allowed within this buffer without prior approval.
- Revegetation of disturbed riparian areas shall be conducted as soon as possible following completion of construction activities.

5.5.3.2.2 Benthic Communities

Benthic communities are comprised of bottom-dwelling organisms including plants, invertebrates, and vertebrate animals that inhabit the bed of a water body. The species present in benthic communities are often characterized by the predominant size or type of substrate along with the hydrodynamic condition. For example, the typical

organisms that inhabit a silty substrate in still waters (pelephilic benthos) will differ from those that inhabit a silty substrate in flowing waters (pelorheophilic benthos). The diversity and abundance of individual species within a benthic community can serve as indicators of the health and proper functioning of an aquatic ecosystem. As such, a general goal in minimizing environmental impact to aquatic ecosystems can be achieved by minimizing changes to the ambient conditions of benthic communities.

There is general consensus that accumulation of sediment can cause deleterious changes to benthic organisms living in the substrate. There is likely to be a drop in dissolved oxygen (DO) caused either by direct smothering or through increased respiration of bacteria that process organic sediments. The lower DO conditions have the potential to reduce the number of benthic organisms that can survive in the area, or there may be a transition to other benthic species more suited to the new conditions. Benthic community changes could in turn lead to changes in the fish and bird communities that feed on the organisms (CCC 1999).

Projects utilizing cage culture involve the addition of feed to the cage units, and the deposition of uneaten feed and feces creates a potential for sediment accumulation on the bed beneath and surrounding the cages. While there are no known studies evaluating the affects of freshwater cage culture, there have been numerous studies evaluating cage culture in the marine environment. From 1987 until 1996, all salmon net-pen projects in Washington State were required to monitor sediment chemistry, water chemistry, and benthic community characteristics (Nash 2001). Analysis of this extensive database indicated several generalities regarding benthic impacts, including:

- Sediment grain size and water depth are the primary factors determining the structure of an undisturbed infaunal community.
- In undisturbed reference areas, the total organic carbon (TOC) level in sediments was strongly correlated to the proportion of silt and clay fines in the sediment.
- The redox potential and health of the infaunal community associated with a particular sediment grain size were well correlated with measured TOC levels. This allows TOC to be used as a screening tool to evaluate benthic health indirectly. In comparison to direct analysis of the infaunal community, the TOC screening tool has the advantage of being fast and less costly.
- Net-pen projects located in well-flushed areas (having currents greater than 1.7 feet per second) frequently exhibited increased abundance and taxa richness of infaunal communities, even at high levels of salmon production.
- Net-pen projects located in poorly flushed areas (having currents less than 0.3 feet per second) often exhibited significant increases in sediment TOC, even when located in deep water. At the same time, the adverse impacts were generally restricted to an area within 50 to 75 feet of the farm perimeter. Furthermore, it was shown that farm management practices were influential in reducing adverse effects.
- Recovery of the benthos occurred naturally during fallow periods or following cessation of farm activities. It was common to observe an initial three month period of rapid increase in abundance and species diversity, followed by a 3 to 25 month period of more gradual recovery.

Any individual project proposing the placement of a structure in a lake or river must

obtain a Streambed Alteration Agreement from CDFG in accordance with Section 1600 of the Fish and Game Code. If the lake or river is designated as a navigable water of the U.S., there would be the additional need for an approved Form 4345 administered by the COE. Both agencies exercise authority to ensure there will be no significant disruption of sensitive benthic communities. The following mitigation measures could be used to avoid or minimize impacts to benthic communities:

- Establishment of a Sediment Impact Zone (SIZ) and associated TOC trigger points that would be used to monitor acceptable sedimentation levels. The limits of the SIZ would ideally reflect the biological productivity of the site's benthos and the presence of adjacent valuable resources. The TOC trigger points would be appropriate for the type of sediment at the site. Existing monitoring programs in Washington use a biennial monitoring schedule, with additional sampling required if measured TOC levels exceed the trigger point (Nash 2001).
- Consideration of the site-specific conditions for average current, water depth, and sediment type when assessing the appropriate production level or density of organisms for an individual project (Newell and Shumway 1993, Nash 2001). Examples of guidelines for siting and production level are discussed further in Section 5.9.3.2.2 with regards to waste discharge.

5.5.3.3 Fish and Wildlife Migration

Terrestrial wildlife migration is not expected to experience any adverse effects from inland aquaculture facilities due to the limited size of land-based structures. Avian wildlife migration often benefits from inland aquaculture facilities that utilize pond culture. The ponds create habitat for resting and feeding of migratory waterfowl. Wading birds often feed and nest in the habitat created at pond edges.

Some aquaculture facilities may have in-water structures located within a natural water course. For inland aquaculture facilities, these structures are most likely to consist of a water supply intake structure and an outfall structure. In the case of cage culture facilities, there would be one or more cages anchored within the water and possibly a boat dock or ramp to gain access to the cages. These structures may have potential to impact fish migration, as described in more detail later in the following paragraphs.

In shallower streams and rivers, a water supply intake structure may require a concrete sill and damboards to create ponded conditions that can divert water into the intake. These sills have the potential to be a barrier to fish migration. In addition, with any system that diverts water out of a natural water course, there is a potential that fish will be entrained into the water supply.

Cages and boat docks are in-water structures that may displace a direct line movement of fish. However, the structures are generally small and would not create a delay to migration.

The construction of in-water structures may cause a temporary disturbance of soils that results in a short-term increase in turbidity. Construction equipment and vehicles may compact the bottom substrate and damage benthic organisms. The significance of these impacts would vary by season. For example, use of areas for spawning, egg incubation and nursery habitat is likely to be confined to certain periods of the year, dependent on the species in question.

Proposed activities that would place a structure in or modify a river, stream or lake requires an approved Streambed Alteration Agreement from the California Department of Fish and Game. In the course of reviewing such permit applications, the agency will assure there are no significant adverse affects to fish migration. The following list provides examples of measures that have been required by CDFG in response to site-specific conditions of a proposed project.

- Fish passage facilities (such as fish ladders) will be incorporated into any barrier that obstructs fish migration. A frequent reference used during the design development of these facilities is "Fishway Design Guidelines for Pacific Salmon" by Bates (1993).
- Water diversions must be equipped with screens to prevent fish entrainment. Such screens will comply with the CDFG "Fish Screening Criteria" dated June 19, 2000. These criteria incorporate the screening requirements specified by the Southwest Region of NMFS.
- Equipment shall not be operated in stream channels, except as may be necessary for structure construction. In these cases, the entire streamflow shall be diverted around the work area by a cofferdam or other barrier such that the remaining channel is capable of permitting upstream and downstream fish movement.
- In-water work periods may be established to avoid potential impact during migration season or other periods of biological sensitivity.

Through approval of the Streambed Alteration Agreement, CDFG will assure there will be no significant impact to fish migration, or that there will be appropriate mitigation to reduce the potential impacts to levels that are less than significant.

5.5.3.4 Predator Species

Aquaculture facilities contain dense populations of fish and other aquatic organisms that can provide convenient foraging grounds to predators of the cultured species. Common predators at inland aquaculture projects include several species of birds and a few mammal species. Attempts by predators to capture the cultured organisms can damage facility equipment and can injure or kill the prey. Predation can result in significant and even total losses of product.

Birds can be grouped into "swimmers", "waders" and "fliers". The common swimmer predators in California include cormorants and mergansers. Wading predators include several species of herons. The common flier predators are kingfishers, gulls, pelicans and osprey. Daily consumption rates for many of these birds are estimated to be roughly 0.3 lb/day, though rates as high as 1 lb/day have been measured for cormorants (Stickley 1990).

An evaluation of great blue heron predation on farmed catfish fingerlings found greater losses in ponds with "diseased" catfish (catfish temporarily disabled by subcutaneous air injections) or "undesirable" fish (bluegills) than in normal ponds (Glahn et al. 2000). It has been suggested that the presence of large numbers of avian predators may aid the operator in detecting poor health conditions or large numbers of "trash" fish within specific rearing units of a facility.

The common mammalian predators at inland aquaculture facilities are otters and mink. The consumption rate of these predators is not known. They are nocturnal in habit and

have a tendency to attack relatively large fish, eating the most desirable parts and leaving the rest (Pillay 1992).

Measures are sometimes used by aquaculturists to reduce predation. The following is a list of common techniques:

- Anti-predator netting or wires can be installed over the surface of ponds, raceways and tanks to exclude or discourage bird predation.
- Perimeter fences can be installed to discourage otter predation. Some fence designs are electrified, while others utilize a wire mesh that extends 1 or 2 feet below finish grade to prevent burrowing.
- At cage facilities, anti-predator netting is often suspended over the cage surface to prevent bird access. In cases where there are significant numbers of swimming predators, a subsurface anti-predator net is typically suspended from walkways or outriggers to create a total enclosure 3 to 9 feet out from the growing pen. Weights are attached to subsurface predator nets to keep them taut and reduce movement toward the growing pen.
- Mortalities are generally removed from facilities as often as possible to reduce the attraction to scavengers.
- Acoustic harassment devices (AHDs) create loud noises to scare predators away. Different types of devices include pyrotechnics, automatic exploders using propane gas or acetylene, recorded distress calls, and live ammunition. The effectiveness of these devices often diminish over time as the animals become accustomed to the noise. Increased effectiveness may occur by using a variety of harassment devices and changing them often (Littauer 1990).
- Visual frightening techniques include scarecrows, mylar ribbon, and hawk silhouette kites. Like AHDs, these techniques are more effective when changed frequently or used in conjunction with other devices (Littauer 1990).
- In severe cases, a depredation permit may be issued to allow lethal control measures. The permits are issued by the USFWS, NMFS, or CDFG, depending on the species. Permit approval requires thorough justification of the need, and conclusive evidence that there will be no significant adverse effect to the population of concern. The permits contain very restrictive terms regarding allowed numbers of take.

The method of predator control appropriate for an individual project will be dependent on the species produced, type of rearing unit used, site location, and the abundance of the predator population. There is a strong performance record of predator control design to aid in selection of the most effective control measures for an individual site. Consequently, potential environmental impacts relating to predator species will be less than significant.

5.5.3.5 Introduction of Exotic Species

The Department of Fish and Game defines an exotic species as any animal or plant that is not native to California or which does not presently exist as a viable population in a wild condition in the State. The Department acknowledges that some formerly exotic species have become established in California by the aid of humans and classifies these

organisms as previously established non-native species. Non-native species present an environmental concern because there may be no natural predators to the species, allowing the species to dominate competition for food and habitat resources, thereby reducing available resources for native species.

Exotic species issues are regulated within the California aquaculture industry by the Department of Fish and Game (CDFG). Species to be cultivated are identified in the Aquaculture Registration submitted annually by facility operators. Any registration that includes a proposal to import live exotic species will trigger the need for a special permit by the Fish and Game Commission. Permit approval requires acceptance by CDFG that measures to confine the exotic species will be adequate.

Exotic species issues are also regulated through two Federal agencies: the U.S. Fish and Wildlife Service (USFWS) and the Animal and Plant Health Inspection Service within the U.S. Department of Agriculture (APHIS). The USFWS has responsibility for regulating importation of injurious fish and wildlife into the U.S. under the Lacey Act. APHIS has a broad mandate relating to the importation and interstate movement of exotic species under the Federal Plant Pest Act and the Plant Quarantine Act. The primary concern of APHIS is the protection of agricultural crops. Compliance with these Federal regulations is assured under the special permit noted above approved by the Fish and Game Commission.

A past incident occurred in which the introduction of an exotic marine species, the sabellid worm, was accidentally introduced to California when infested abalone were imported into an aquaculture facility. A recent ruling (CCC 1999) provides a thorough discussion on the background of this event and the CDFG response in sampling, eradicating the worms from existing facilities, and implementing programs for preventing new infestations. The incident provides assurance that the existing CDFG regulatory process provides effective management of exotic species. Today's requirements for importation and interstate transport of exotic species involve certification by Federal and/or State inspectors. As a consequence, the risk of introductions of exotic species is less than significant.

5.5.3.6 Disease Transmission

Two documented examples of "disease transmission" have occurred between cultured and wild Atlantic salmon: one involving a freshwater parasite in Norway and a second involving the IHN virus in Japan (Nash 2001). However, in both of these cases, the disease was caused by exotic pathogens accidentally imported with infected Atlantic salmon stocks, to which the wild populations had little or no immunity. An analogous incident occurred in California when an exotic parasite, the sabellid worm, was accidentally introduced to California waters by way of infested abalone imported into an aquaculture facility. Though the issue of exotic pathogens shares many of the same concerns as disease transmission, the regulatory framework for protecting against introduction of new diseases is more appropriately addressed by the exotic species aspects of the issue, which is discussed in detail in Section 5.5.3.5. The remainder of this subsection will address pathogens that are endemic to the natural aquatic ecosystem of California, and hence will focus on whether aquaculture has the potential to increase the incidence of disease that may occur naturally in the environment.

Diseases are an inherent part of the natural aquatic ecosystem, and yet there is an

impression that disease originates in the culture environment (Hedrick 2001). In the aquatic environment, cultured aquatic species can act as reservoirs of pathogens to wild species, and vice versa (WDF 1990). Most disease reports for fish operations refer to intensive culture conditions that may enhance the impact of the disease. Wild populations may not become affected from exposure to these pathogens due to more favorable environmental conditions, such as better water quality or lower population densities (Pillay 1992). The technical literature indicates that there is a risk of transmission of pathogens from cultured species to wild species, but that risk is likely not a significant problem (WDF 1990; Journal of Aquatic Animal Health 1998). In one of the premier trout streams in Washington, all of the stream flow consists of effluent from an Atlantic salmon hatchery. There have been no reports of diseased trout in this stream (Nash 2001).

The pathogen, or causative agent of disease, is the focus of surveillance or control programs (Hedrick 2001). Focus upon the pathogen occurs because they are discrete agents or organisms that are readily identifiable with various laboratory techniques. Regulatory agencies will be cautious and conservative in the management of pathogens (Hedrick 2001). Regulatory actions can include limits on movements of live aquatic species or products, or orders for stock destruction and or facility disinfection (Hedrick 2001).

Pathogens are not uniformly distributed throughout the aquatic environment (Hedrick 1997). Variations in the distribution of pathogens can occur on a local to global level. Methods to prevent the spread of pathogen are implemented by State and Federal resources agencies. Agencies apply restrictions to species or product movement based on a list on notifiable diseases. These diseases have been identified by the regulatory agencies to be of greatest concern due to the level of risk to the resource if they were disseminated throughout the aquatic environment.

To control the spread of pathogens, management zones are typically defined by the regulating agencies. These zones can be based upon geographical regions or watershed locations (Hedrick 1997). Identification of endemic pathogens to each zone is accomplished by surveillance of the aquatic species occurring within each zone. This includes both aquaculture species and wild occurring species. Aquaculture species are subject to inspection and certification at various levels in order to meet the transfer requirements of the receiving state or country. CDFG has recently implemented salmonid fish and egg movement restrictions to within drainages. The fish pathogen management goal of CDFG is that of no expansion of the range of the pathogen shall occur from fish or egg movements (Dr. Bill Cox, CDFG, pers. comm. 4/13/00). Eggs or fish that test positive for a pathogen are not allowed to be moved within a drainage if that movement would expand the range of the pathogen. Fish or organisms with clinical disease are not allowed to be moved (Dr. Bill Cox, CDFG, pers. comm. 4/13/00).

5.5.3.7 Escapement

Escapement of organisms from an aquaculture facility has the potential to establish a population in the wild that would compete for food sources and habitat normally used by native populations. If the cultured organism also occurs naturally in the area, there is the additional concern that the cultured organisms could interbreed and cause genetic impacts to the local population.

The potential significance of impacts from escapement depends on three variables:

1) that significant numbers of organisms escape from the facility,
2) the ability of the fugitive organisms to outcompete native populations, and
3) the ability of the fugitive organisms to interbreed with native populations.

For all aquaculture facilities, there is a strong economic incentive to minimize the loss of product. A mitigation measure used for some land-based tank facilities is to screen the discharge outfall, using a slot size to prevent escapement of the species of concern. Cage culture facilities may use a double row of nets to minimize escapement. Nonetheless, escapement of organisms from culture situations can occur due to enclosure/screening failures from weather related incidences or from predator damage.

Escapement levels have been estimated in the Atlantic salmon net-pen industries of British Columbia and the Pacific Northwest. In the period between 1980 and 1995, there was a total estimated Atlantic salmon escapement of 1 million fish, or roughly 62,000 fish each year on average (Nash 2001). However, fewer than 20 adult Atlantic salmon were captured during a survey of all Washington river systems in 1997, and no naturally-spawned Atlantic salmon have been observed in Washington rivers to date (Nash 2001). In British Columbia, around 100 naturally-spawned juvenile Atlantic salmon were counted during a survey of the Tsitika River, yet it was also noted these fugitives made up approximately 1% of all salmonids in the river and presented no competition for food or rearing space (Nash 2001). These findings suggest that escaped Atlantic salmon are not surviving in adequate numbers to have an adverse affect on native species. There have been no reported genetic interactions between Atlantic salmon and Pacific salmonids in the Pacific Northwest. Even under controlled laboratory conditions, viable hybrids between Atlantic and Pacific salmon are difficult to produce (Nash 2001).

It is recognized that data regarding Atlantic salmon escapement in the Pacific Northwest cannot serve as a predictor of the response that other aquacultured species might exhibit if significant escapement occurs. However, it serves to illustrate the extent of monitoring that is typical regarding fisheries management issues. For escapees to cause a negative impact they would have to survive once they have escaped, be able to interbreed with native populations, or escape in sufficient numbers to outcompete native populations (WDF 1990). If the escapees are able to breed with native populations, extensive genetic impacts are likely limited and temporary without a constant infusion of numerous escaped fish into the wild population (WDF 1990). All of these issues are evaluated by CDFG during the review of site-specific applications for proposed aquaculture projects. Any concerns regarding potential impacts from escapement will be appropriately mitigated to assure that effects are less than significant.

5.5.3.8 Sustainability of Fish Meal

A variety of farmed animals including poultry, pigs and fish are raised on feed containing fishmeal and fish oil. Fishmeal is derived primarily from small, bony, oily fish such as anchovies, sardines and menhaden, commonly referred to as forage fish. There are limited outlets in which forage fish are desired as a human food, and roughly one-third of the global catch of forage fish is processed into fishmeal each year (Goldburg et al. 2001). The principal fisheries for forage fish occur in Peru and Chile.

Over the past 10 years, the average annual worldwide production of fish meal has been on the order of 6.5 million metric tons (Hardy 2000). In 1998, about 40 percent of the total fish meal production was further processed into fish feed. With the aquaculture industry growing rapidly, there is concern that an increased demand for fish feed and fish meal will lead to an increased exploitation of forage fish, which in turn could impact natural populations of fish, mammals and seabirds that rely on the forage fish for food (Goldburg and Triplett 1997, Goldburg et al. 2001).

Conditions of varying supply and demand for fishmeal have lead to price volatility in the world marketplace. An extreme example of this was seen in 1998, when an El Nino event resulted in drastically reduced landings in Peru and Chile and subsequently led to price increases approaching double the normal price (Hardy 2000). This price volatility has been a key factor driving the research focus of major fish feed producers over the past decade, to find alternative, vegetable-based sources of protein and oil that can be obtained with greater predictability in yield, shorter transport distances, and greater price stability. Research and development of these new feed products includes confirmation that they provide the essential nutrients for optimal fish growth, and that they remain sufficiently palatable and digestible to ensure a cost-effective Feed Conversion Ratio (FCR). (The FCR is the ratio of the amount of feed used to produce a given weight of fish. A common goal in the fish feed industry is to strive for one pound of fish feed producing one pound of cultured fish.)

Nutritional requirements and feed conversion characteristics vary by fish species. Catfish, tilapia and carp, for example, are omnivorous fish that can digest and utilize vegetable-based protein much more effectively than carnivorous fish species such as salmon, trout and sea bream. The fish feed industry has responded to these differences by developing a variety of commercially available products that strive to achieve the most cost effective feed source for a given species. Standard fish feeds sold in the United States for catfish and tilapia utilize significant amounts of vegetable protein and vegetable oil, such that it takes only about 0.3 to 0.6 pounds of wild fish to produce one pound of catfish or tilapia, respectively (Goldburg et al. 2001). Salmon and trout feeds currently on the market are requiring about 1.5 pounds of wild fish to produce one pound of salmon or trout (J. Mann, EWOS Ltd., pers. comm. 11/12/02). Marine finfish and eels, reported to require more than four pounds of wild fish to produce one pound of product (Goldburg et al. 2001), are cultured to a very limited extent in California. The poor feed conversion implied in the values for marine finfish and eels suggests the use of a "wet feed", comprised of ground fish and/or animal byproducts and a small amount of vegetable binder. While still used in Japan and many developing countries, the use of wet feed in the United States was already being phased out of salmon and trout production by the late 1950s in favor of the semi-purified diet and the Oregon Moist Pellet, formulated for use in state and federal fish hatcheries (Hardy 2000). These initial feeds formed the basis of today's commercially-driven fish feed industry. The fish feed industry is continuing research and product development to reduce fishmeal utilization, both for greater price stability and in response to consumer demand for more sustainable products.

The world's major resources for fishmeal production have controls imposed on their utilization. Almost all the resources are subject to total catch limits, area catch limits, minimum mesh sizes, fleet capacity controls, closed areas, and seasonal bans. Some are also subject to minimum landing sizes. In Peru and Chile, the closed areas for anchovy

and sardine are now enforced by satellite tracking (Barlow 2001). The magnitude and frequency of monitoring devoted to forage fish utilization is evidence that these resources will not be impacted at significant levels. As an example, recovery of stocks following the 1998 El Nino collapse was rapid in the South American fishmeal fishery, indicating that these sources are robust and sustainable at the present capture levels (Scottish Executive Central Research Unit 2002).

There are few consumers around the world that consume forage fish directly as part of their diets. How forage fish and fishmeal are used, whether for pet food, agriculture of pigs and chickens, or as an aquaculture feed ingredient is ultimately determined by the market place. When the supply of fishmeal becomes scarce, the cost increases, causing demand to decrease. The agricultural feed industry has made great gains reducing reliance on fishmeal in efforts to develop least cost feeds. Continued research and development of feeds using other protein sources should ensure that fishmeal is used for its most highly valued purpose.

There are no known standards, policies or ordinances in California or in the federal government that control the use of fishmeal. Consequently, it is not feasible or appropriate to define a threshold of significance for fishmeal utilization by proposed aquaculture projects. No significant local environmental impacts will occur due to fishmeal utilization.

5.5.4 Summary Discussion of Thresholds of Significance and Mitigation Measures

The potential for an inland aquaculture facility to have a significant adverse effect on biological resources has been discussed in the preceding subsections from a programmatic basis, focusing on eight issues that most commonly arise with these types of projects. The specific extent to which these effects may occur, and the mitigation measures that will successfully reduce these effects to a level that is less than significant, will be dependent on site-specific characteristics. During review of an individual aquaculture project, the local agency and all responsible agencies will ensure these site-specific features comply with the relevant laws establishing their respective permit authority. Most notably, CDFG will review every application for an Aquaculture Registration to ensure construction and operation of the facility will not provide significant risk to fish and wildlife resources. The following table reiterates the biological resource issues discussed in the preceding subsections, as well as those noted in the environmental checklist not requiring a more detailed discussion. The table also provides a general threshold of significance for each issue, and summarizes mitigation measures that, when necessary, can be applied on a case-by-case basis to reduce the biological impacts to levels that are less than significant.

Issue	Potential Threshold of Significance	Potential Mitigation Measures to Reduce Impact to Less than Significant
Special status species	Site contains lands defined as critical habitat for threatened or endangered salmonid species; or surveys identify on-site wetlands and/or rare, threatened and endangered plants and animals; AND relevant responsible agency determines proposed project will harass or harm listed species.	• Avoid or minimize impact to critical habitat, sensitive habitat, and wetlands • Insure compliance with other biological resource issues
Sensitive habitat	Site contains designated wetlands, riparian habitat, benthic community or other identified sensitive natural community; AND relevant responsible agency determines proposed project will cause significant adverse effect to the habitat.	• Avoid or minimize impact to sensitive habitat • Provide constructed wetlands • Dedicate credits to ecosystem preservation bank or habitat mitigation bank • Establish an impact assessment zone and monitor relevant indicators of impact, and adjust production level as needed to stay within acceptable impact levels
Fish or wildlife migration	Relevant responsible agency determines proposed in-water structures will cause significant adverse effect to fish migration.	• Incorporate fish passage facilities (such as fish ladders) into any barrier that obstructs fish migration • Provide screens at water diversions to prevent fish entrainment • Conduct in-water construction during approved in-water work periods to avoid potential impact during migration season or other periods of biological sensitivity.
Predator species	Relevant responsible agency determines proposed project will attract such significant numbers of predators as to disrupt existing ecosystem balance.	• Provide anti-predator netting or fencing to prevent predator access • Use acoustic harassment devices (AHDs) and/or visual frightening techniques to scare predators away • Obtain a depredation permit to allow lethal control measures, and comply with permit terms regarding allowed numbers of take
Introduction of exotic species	Project proposes to import live species defined as "exotic" by CDFG or by the Animal and Plant Health Inspection Service within the U.S. Department of Agriculture (APHIS), or defined as "injurious" by USFWS.	• Provide measures to confine the exotic species sufficient to obtain approved permit from CDFG
Disease transmission	Project proposes culture of species with high risk of disseminating a notifiable disease (per CDFG determination).	• Develop CDFG-approved plan describing inspection and certification requirements for product transfer, and Best Management Practices for fish health monitoring at facility

(continued next page)

Issue	Potential Threshold of Significance	Potential Mitigation Measures to Reduce Impact to Less than Significant
Escapement of cultured species	Cultured species determined by CDFG/NMFS/USFWS to present high risk of escaping and surviving in large enough numbers to compete with native populations or cause genetic impacts through interbreeding.	• Provide physical barrier (such as effluent screens or second row of cage netting) to prevent escapement
Local biological resources, such as trees	Proposed project conflicts with local policies or ordinances protecting biological resources (such as a tree preservation policy or ordinance)	• Design facility to avoid or minimize impact to the subject local resource • Provide appropriate mitigation as specified by local agency
Approved Habitat Conservation Plan	Proposed project conflicts with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan	• Revise facility design to comply with the provisions of the plan • Provide appropriate mitigation as specified by the plan administrator

5.6 CULTURAL RESOURCES

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐

5.6.1 Environmental Setting

Cultural resources are the tangible remains of past human activities. Cultural resources include physical resources and intangible cultural values pertaining to prehistoric and historic archaeology, Native American ethnography, and history. Three subcategories of cultural resources have been identified for discussion in this PEIR. They are: archaeological and historic resources, ethnographic resources, and paleontological resources.

Archaeological and historic cultural resources are often found near natural watercourses, springs or ponds, or on elevated grounds such as ridges and knolls. Some sensitive areas fall outside of these bounds as well. For example, channels of natural watercourses change through time and thus some archaeological sites may be found in areas distant from present-day watercourses. In addition, many sites may have been covered by alluvial deposits and will not be evident by a ground surface inspection. Examples of historic site types are railroad grades, dams and culverts, farmsteads, lighthouses, refuse deposits, and architectural structures (CALFED 2000).

The ethnographic resources of California are substantial. Over 100 Native American tribes inhabited California prior to European colonization. Many of these tribes were located along the coast, especially in southern California. A small number occupied the northeastern portion of the state where life was more difficult owing to the harsh climate. Although many tribes were hunter-gatherers, the Central Valley tribes relied upon the Valley Oaks for acorn meal and lived a relatively sedentary lifestyle. When European colonization began in 1769, Native peoples were relocated near missions and required to work. With this influx of new people, the natives lost 2/3 of their population to introduced diseases. The remaining native population then declined even further as whole tribes were displaced or extirpated during the gold rush of the mid 1800s. Reservations were finally secured by the federal government by the latter part of the 19th century (Veirs et al. 1998).

Paleontological resources are the fossilized remains of plants and animals. Fossils are of scientific value due to the clues that these unique, non-renewable resources provide to the history of life on earth.

5.6.2 Regulatory Framework

Cultural resources in California are managed under a broad spectrum of Federal and State statutes and regulations. Federal agency involvement may occur for proposed individual projects on the basis of the following Federal laws:

- The Antiquities Act of 1906 (16 U.S.C. 431-433) was the nation's first general purpose cultural resource management statute prohibiting the excavation of antiquities from public lands without a permit from the Secretary of the Interior. In 1974, the Ninth Circuit Court of Appeals found this act to be vague due to its failure to indicate the age an object had to be in order to be considered an "object of antiquity". The result was the enactment of the Archeological Resources Protection Act (16 U.S.C. 470aa-mm: ARPA) that serves to manage disturbances to archaeological sites, features, and objects on Federal and Native American tribal lands.
- The National Historic Preservation Act (NHPA) of 1966 (16 USC 470-470w-6) requires Federal agencies to consider the preservation of historic and prehistoric resources during project planning. The Act authorized the National Register of Historic Places (NRHP) and established the Advisory Council on Historic Preservation as an independent Federal entity. Section 106 of the Act requires Federal agencies to take into account the effects of their undertakings on historic properties and properties eligible for the NRHP.
- The Advisory Council on Historic Preservation (36 CFR 800) establishes procedures for compliance with numerous historic preservation statutes, particularly Section 106 of the National Historic Preservation Act of 1966. These regulations also define the Criteria of Effect and Adverse Effect (800.5), stipulate procedures for affording the Council opportunity to comment (800.6), define the role of the State Historic Preservation Office (SHPO) in the Section 106 review process (800.7), set documentation requirements (800.8), and describe procedures to be followed should significant historic properties be discovered during construction (800.11).
- The Native American Graves Protection and Repatriation Act of 1989 (PL 101-601) vests ownership or control of human remains and Native American cultural items excavated on Federal or tribal lands in California to designated Native American Tribes. The Act also requires notification of the appropriate Federal agency when Native American cultural items are discovered. It specifies that Federal agencies and museums provide an inventory of Native American human remains and associated funerary objects and to notify appropriate Native American tribes of this inventory. Furthermore, it provides for the repatriation of Native American human remains and cultural objects.

The California legal provisions that may be relevant to proposed individual projects are discussed below.

- The California Environmental Quality Act of 1970 (CEQA) is patterned after the National Environmental Policy Act (NEPA), but goes beyond NEPA in the extent of protection provided for archaeological and historic resources. State and local government entities are required to protect historic and prehistoric archaeological resources that qualify for the NRHP or are deemed significant.
- Under CEQA, historic resources over 45 years in age must be evaluated for eligibility to the California Register of Historic Resources. The same criteria defined in 36 CFR

60.4 for the NRHP are used to determine eligibility for the California Register.

- California Public Resources Code 21083.2 (1993) provides for reasonable efforts to be made to preserve archaeological resources in place or "left in an undisturbed state".
- The Native American Heritage Act of 1976 (NAHA) established the Native American Heritage Commission (NAHC) that protects Native American religious values on State property (California Public Resources Code 5097.9).
- California Public Resources Code 6313 (1995) provides title vested in the State to all abandoned shipwrecks and all archaeological sites and historic resources on or in the tidal and submerged lands of California.
- California Public Resources Code 30244 (1993) states that reasonable mitigation measures shall be required where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer (SHPO).

5.6.3 Environmental Impacts

California's diverse inland area contains literally hundreds of cultural resources. Potentially significant prehistoric and historic resources important to the development of inland regions are known to exist along major rivers and streams. Resources may include remnants of prehistoric campsites, quarries, ritual sites, rock art sites, permanent village sites, and various artifactual materials. Historic resources may include structures such as residences, industrial buildings and complexes, small farms and fishing operations. In addition, resources may be found submerged in water, including sunken boats, fishing weirs and paraphernalia, abandoned docks, and artifacts. The identification of prehistoric and historic resources and the determination of significance should be addressed during the preliminary review phase of site-specific project applications.

Methods and assumptions for evaluating impacts on cultural resources vary according to discipline. Impacts to paleontological and archaeological resources may occur as the result of ground disturbing activities. Impacts on historic structures may result from activities that modify physical features, the character or the setting. The significance of the impact depends largely on the relative importance of the resource.

It is not possible to assess the site-specific concerns related to archaeological and paleontological resources at the programmatic level of this PEIR. It can be assumed that the cumulative impact of inland aquaculture facilities will be less than significant, since any individual projects having significant resources will be mitigated to acceptable levels in accordance with applicable State, Federal and local regulations prior to construction. As a result, inland aquaculture development will have less than significant impact with regards to:

- change in the significance of a historical resource;
- change of an archaeological resource;
- unique paleontological resources or unique geologic features;
- disturbance of any human remains.

5.7 GEOLOGY AND SOILS

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☒	☐
c) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risk to life or property?	☐	☐	☒	☐
d) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☒	☐

5.7.1 Environmental Setting

California contains a wealth of mineral resources and high topographic diversity. The rich soil of Central Valley, the gold of the Sierra and oil in various locations throughout the state as well as offshore are all examples (CERES 1999). Geological studies are underway to increase the understanding of such diverse issues as earthquakes, mineral locations and volcanic hazards (CERES 1999). Geology of the region includes several mountain ranges and a dynamic coastline. The current shape of these features is the result of several erosional and depositional processes occurring through time.

The Farallon and North American tectonic plates in the western portion of the state have contributed to much of the existing topography in the region. The San Andreas Fault is a product of the crustal movements of these plates (Veirs et al. 1998). Volcanic and tectonic activity emanating from this and other faults helped to form numerous mountain ranges. These geologic formations were then subjected to the erosional

impacts of glaciation during the ice ages as well as by wind and rain to create the landforms present today. Coastal mountains trace a sinuous 800-mile course from the northwest corner of Del Norte County south to the Mexican border. Except for a break in the chain at the Golden Gate, they form a continuous series of ranges and valleys, separating the coast from the Great Central Valley and the deserts of the interior. This mountainous barrier has a dramatic effect on climate: storms originating over the Pacific Ocean bring rain to the western slopes, while the eastern slopes remain relatively dry (CERES 1999).

California can be split into several geological provinces discussed below. Note that the lines of demarcation for these provinces are not fixed, as there is a gradual grading in the landscape (Brown et al. 1987).

Provinces in the northern portion of California are Klamath Mountain, Cascades, Modoc Plateau, Coast Range, Central Valley, and Sierra Nevada. The Central Valley province is comprised of the valleys of the Sacramento and San Joaquin rivers and is bordered by the Klamath Mountains to the north and the Coast Range to the south. This region contains unique resources largely due to protection from the mountain ranges and rich soils. In the Cascades of northern California, mafic lava exists along with other volcanic rocks that contain alluvium, lake deposits and glacial deposits. Lava beds are similarly found in the Modoc Plateau. The Modoc Plateau rocks comprise this flat, yet high elevation landscape. Alluvial sediments created from uplifts and ensuing erosional activity are present in the Sierra Nevada (Veirs et al. 1998). One of the most notable mountain ranges, the Sierra Nevada, runs approximately 400 miles and is composed mainly of granite. This east-west range slowly rises to a dramatic height at its eastern end.

Provinces of lower California include the Basin and Range, Peninsular and Transverse Ranges, and Mojave Desert. Major valleys such as Owens, Saline, Panamint, and Death Valleys separate the north-to-south White, Inyo and Panamint Ranges of the Basin and Range province. The granitic Peninsular and Transverse Ranges of southern California have a complex geography with several low-lying areas interspersed with peaks as high as 11,500 feet. The topography of the Mojave Desert is much less systematically oriented than the noticeable north-south alignment of the Basin and Range mountains. Broader basins and less continuous mountain ranges create a more subdued landscape here (Harden 1998). Consisting of a mixture of mudstone, sandstone, and conglomerate, the formation also contains an assortment of fossils. Alluvium covers the basin floor. Active detachment and range-front faults are commonly found here.

5.7.2 Regulatory Framework

Design criteria for seismic loading and other geologic hazards are provided in the seismic elements of city and county general plans. These documents typically incorporate the design standards in the Uniform Building Code (UBC) and are informed by the Alquist-Priolo Special Studies Zone (APSSZ) Act as described below.

The UBC provides design criteria for geologically induced loading that govern the sizing of structural members. The UBC also provides calculation methods to assist in the design process. City and county general plans incorporate the provisions of the UBC by reference and add additional safety factors for critical structures.

The APSSZ Act (California Public Resources Code Section 2621 et seq.) provides policies

and criteria to assist cities, counties, and state agencies in prohibiting development on active faults. The APSSZ Act requires the State Geologist to delineate special study zones to encompass all potentially and recently active traces of named faults and other such faults, or fault segments that are deemed sufficiently active and well-defined as to constitute a potential hazard to structures from surface faulting or fault creep. Maps delineating these "special studies zones" are provided to cities, counties, and state agencies. Cities and counties have established special studies zones.

5.7.3 Environmental Impacts

Earthquake fault hazards and soil characteristics of a proposed aquaculture facility are dependent on its location, and hence any assessment regarding seismic concerns, soil stability, or septic system suitability must be reserved until the site-specific conditions are known for an individual project application. In general, however, inland aquaculture facilities involve low-level structures and they are occupied by humans at low densities, producing minimal risk to life. It can be assumed that any individual project having seismic, soil stability, or septic suitability concerns will be designed and constructed in accordance with applicable State, Federal and local regulations. On the programmatic basis of this PEIR, it is assumed that inland aquaculture development will have less than significant impact with regards to seismic issues, unstable soil, expansive soil, or inadequate soils for waste water disposal systems.

Inland aquaculture facilities proposing use of pond culture methods will typically involve construction of several large earthen ponds, ranging in size between 1/4 and 20 acres each. Ponds are frequently constructed by excavating below grade and using the material to build levees around the excavation, resulting in ponds that are partly above and partly below the original ground elevation. The goal in building levees is to make them a strong and erosion-resistant as possible, given the engineering properties of the existing soils. Soil with a high clay content is generally preferred, though it is not a necessity. If the soil has a higher concentration of sand, a lining material such as polyethylene or soil cement may be desirable to seal against leakage. The soil strength in a levee can be greatly enhanced by construction methods that take into account the force and degree of compaction, and the soil moisture at the time of compaction (Steeby et al. 1998). Mulching and seeding is a common method to stabilize the levee surface and reduce erosion; there are several cover grasses that can be used to provide stabilization without causing interference to harvest methods and equipment. In general, it is assumed that pond culture facilities will incorporate these design and construction guidelines to maximize the design life of the levee and minimize the cost of pond repair or replacement. As a consequence, the potential impacts resulting from soil erosion are expected to be less than significant.

5.8 HAZARDS AND HAZARDOUS MATERIALS

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) Be located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, and result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) Be within the vicinity of a private airstrip, and result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒

5.8.1. Environmental Setting

Aquaculture facilities on occasion may use hazardous chemicals as therapeutants for the treatment of pathogens affecting the cultured species, or as disinfectant/growth inhibitors to control undesirable species. When used as a therapeutant, the chemical is introduced into the cultured organism by methods such as mixing the chemical into the process water of the rearing unit, using medicated feeds, or by direct injection. Chemicals used as disinfectants are usually diluted to a prescribed concentration used as an immersion bath or applied directly to the item of interest.

Control of aquatic weeds is a common problem for aquaculture facilities that use pond culture methods. Excessive growth of aquatic weeds can cause harmful effects that include oxygen depletion due to rotting vegetation, increased cover for prey animals, and loss of pond volume due to increased sedimentation. Aquatic weed control in aquaculture ponds is commonly achieved through the use of approved chemical herbicides.

Other hazardous materials that may be used at an aquaculture facility include gas, oil or diesel for vehicles and equipment, and materials used for lawn maintenance and terrestrial weed control.

5.8.2. Regulatory Framework

The discharge or release of any material that would impair the beneficial use of the receiving water, both ground and surface waters, is regulated by the Regional Water Quality Control Boards (RWQCBs). Specific restrictions for the discharge of chemicals from aquaculture operations may be defined based on the Water Quality Control Plan for each Region. For example, in the Water Quality Control Plan for the North Coast Region it specifically states that for aquaculture operations "The discharge of detectable levels of chemicals used for the treatment and control of disease, other than salt (NaCl), shall be prohibited." The waste discharge requirements (WDRs) issued to each aquaculture facility by the RWQCB itemize constraints and conditions for chemical use at the facility.

Approval of chemicals and therapeutants for use in the aquaculture industry is regulated by the U.S. Food and Drug Administration (FDA) through the Center for Veterinary Medicine (CVM). There are four categories that drugs or chemicals can be classified into depending on their use or application:

1) Registered or labeled drug or chemical. These compounds must be used in the manner described on the label. In addition, many of these drugs and chemicals have a specified withdrawal time that must elapse before the treated animal can enter into the food chain or be used for human consumption.
2) Extra-label. This is the use of a registered drug or chemical in a manner outside the labeled requirements. Extra-labeled use is allowed as prescribed by a licensed veterinarian.
3) Investigational New Animal Drug (INAD). Use of drugs under an INAD is for the collection of data to support a New Animal Drug Application to either register a new drug or chemical or expand the existing label to cover additional species, rearing temperatures, and/or target pathogens. Specific reporting and testing requirements are required under the INAD program.
4) Low Regulatory Priority (LRP) compounds. FDA has developed a list of compounds that are felt to be relatively safe, and at this time do not need to meet the onerous licensing requirements for new drugs. These compounds must be used for the prescribed indications, at the prescribed dosages, are of an appropriate grade for food animals, applied in accordance with good management practices and do not adversely harm the environment. The compounds that have undergone review by the Food and Drug Administration and have been determined to be new animal drugs of low regulatory priority are listing in Table 5-1.

Table 5-1. Low regulatory priority aquaculture drugs.

Compound	Use
Acetic acid	1000 to 2000 ppm dip for 1 to 10 minutes as a parasiticide for fish.
Calcium chloride	Used to increase water calcium concentration to insure proper egg hardening. Dosages used would be those necessary to raise calcium concentration to 10-20 ppm CaCO3. Up to 150 ppm indefinitely to increase the hardness of water for holding and transporting fish in order to enable fish to maintain osmotic balance.
Calcium oxide	Used as an external protozoacide for fingerlings to adult fish at a concentration of 2000 mg/L for 5 seconds.
Carbon dioxide gas	Used for anesthetic purposes in cold, cool, and warm water fish.
Fuller's earth	Used to reduce the adhesiveness of fish eggs to improve hatchability.
Garlic (whole form)	Used for control of helminth and sea lice infestations of marine salmonids at all life stages.
Hydrogen peroxide	250-500 mg/L to control fungi on all species and life stages of fish, including eggs.
Ice	Used to reduce metabolic rate of fish during transport.
Magnesium sulfate	Used to treat external monogentic trematode infestations and external crustacean infestations in fish at all life stages. Used in all freshwater species. Fish are immersed in 30,000 mg MgSO4/L and 7000 mg NaCl/L solutions for 5 to 10 minutes.
Onion (whole form)	Used to treat external crustacean parasites, and to deter sea lice from infesting external surface of salmonids at all life stages.
Papain	Used of a 0.2% solution in removing the gelatinous matrix of fish egg masses in order to improve hatchability and decrease the incidence of disease.
Potassium chloride	Used as an aid in osmoregulation; relieves stress and prevents shock. Dosages used would be those necessary to increase chloride ion concentration to 10-2000 mg/L.
Povidone iodine	100 ppm solution for 10 minutes as an egg surface disinfectant during and after water hardening.
Sodium bicarbonate	142 to 642 ppm for 5 minutes as a means of introducing carbon dioxide into the water to anesthetize fish.
Sodium chloride	0.5 to 1% solution for an indefinite period as an osmoregulatory aid for the relief of stress and prevention of shock in fish; 3% solution for 10 to 30 minutes as a parasiticide.
Sodium sulfite	15% solution for 5 to 8 minutes on fish eggs to improve their hatchability.
Thiamine hydrochloride	Used to prevent or treat thiamine deficiency in salmonids. Eggs are immersed in an aqueous solution of up to 100 ppm for up to four hours during water hardening. Sac fry are immersed in an aqueous solution of up to 1,000 ppm for up to one hour.
Urea and tannic acid	Used to denature the adhesive component of fish eggs at concentrations of 15 g urea and 20 g NaCl/5 liters water for approx. 6 minutes, followed by a separate solution of 0.75 g tannic acid/5 liters of water for an additional 6 minutes. These amounts will treat approx. 400,000 eggs.

Notes:
1. The Agency's enforcement position on the use of these substances should not be considered an approval nor an affirmation of their safety and effectiveness. Based on the information available at some time in the future, the Agency may take a different position on the use of any or all of these substances.
2. Classification of these substances as new animal drugs of low regulatory priority does not exempt facilities from complying with other Federal, State, and local environmental requirements. For example, facilities using these substances would still be required to comply with National Pollutant Discharge Elimination System (NPDES) requirements. October 11, 1994, Office of Surveillance and Compliance, Center for Veterinary Medicine.

The Department of Pesticide Regulation (DPR), authorized in 1991 through California's Food and Agricultural Code Section 11501, provides for the proper, safe, and efficient use of pesticides (including herbicides, fungicides, and other pest control agents). The program is further authorized to protect the environment from environmentally harmful pesticides by prohibiting, regulating, or ensuring proper stewardship of pesticides, and it assures agricultural and pest control workers of safe working conditions where pesticides are present (DPR 2001). The DPR provides the regulatory direction for appropriate chemical storage and handling protocols for any herbicides, therapeutants or other hazardous materials that may be used at an aquaculture facility. Specific requirements for storage, containment equipment and spill prevention plans would be addressed at the individual project level, when the particular materials and estimated annual usage could be identified.

5.8.3. Environmental Impacts

5.8.3.1 Therapeutants

In general, therapeutants are used only when there is indication of disease at a facility. Aquaculture facilities typically monitor the health and condition of their stock on a routine basis, and as a consequence most operators detect the presence of disease in isolated rearing units before the pathogen has spread throughout the facility. It is typical to apply the therapeutant only to those rearing units where needed.

The therapeutants most commonly used for freshwater culture in California include copper sulfate, formalin, hydrogen peroxide, erythromycin, oxytetracycline, Romet, and Chloramine-T (CDFG, personal communication). Oxytetracycline, Romet and Chloramine-T are frequently used under an INAD or by veterinary prescription as an extra-label use of that compound.

The most common method of applying therapeutants to ponds, raceways and tanks is to add the material to the water supply of the individual rearing unit being treated. As a means of controlling the chemical dose and treatment duration, it is common to shut off or severely reduce the water flow to the rearing unit during the treatment period. In addition, the rearing unit effluent during the treatment period is usually routed directly to the facility effluent treatment system and not allowed to pass through any downstream rearing units. This is especially important at facilities with recirculating systems, where continued circulation could lead to undesirable levels of the residual drug. Once in the effluent treatment system, the residual therapeutant may undergo a detention period that provides adequate deactivation of the drug, or it will be treated in some other fashion to attain the permissible discharge condition allowed by the WDR.

Unless the cage can be enclosed with plastic to contain the chemicals, cage culture operations do not allow for the application of chemicals or therapeutants directly into the cage due to the inability to apply the material in a contained environment. Instead, cage facilities typically administer antimicrobial therapeutants through a feed application method regulated by the FDA. Frequently, this method entails classification as an extra-label use and hence requires prescription by a licensed veterinarian. Such applications would be adjusted as necessary to comply with WDR permit requirements. In addition, appropriate drug withdrawal times would have to be adhered to prior to the fish entering the human food market.

The application of therapeutants at aquaculture facilities is conducted with extreme care and caution, as it is critical to the health and viability of the product. Typical dosage amounts are small and infrequent, resulting in annual levels of transport and handling that are very low. As a consequence, the potential risk from routine use or accidental upset is less than significant.

5.8.3.2 Disinfectants, Aquatic Weed Control and Anti-fouling Agents

A common use of disinfectants at aquaculture facilities is to clean equipment that could potentially cause spread of disease from one rearing unit to another. In similar fashion, ponds, raceways and tanks are often disinfected between harvest and stocking of different production groups. Disinfectants are typically used in a batch method, with no release of effluent during the treatment period. After use, the disinfectant is flushed with large amounts of water, and/or it may be discharged to a municipal treatment system.

The application of disinfectants at aquaculture facilities is conducted with extreme care and caution, as their misuse could result in catastrophic loss of product. Typical usage amounts are small, resulting in annual levels of transport and handling that are very low. As a consequence, the potential risk from routine use or accidental upset is less than significant.

Aquatic weed control at pond culture facilities is frequently conducted with approved chemical herbicides. The presence of food fish and/or non-food fish in a pond determines what herbicides can be used. More restrictions are placed on the use of chemicals under conditions involving food fish, including a minimum withdrawal time before the fish is considered safe to be consumed. The means of application are enforced through the DPR and must be in accordance with labeled instructions that follow FDA and EPA approved guidelines. These measures protect worker safety as well as protect against potential problems associated with vegetation and aquatic species downstream of the pond discharge point (Conte 1995). The DPR offers assistance by professional weed control specialists to assure proper application. On the basis of DPR regulations and the effectiveness of educational and assistance programs, potential impacts from aquatic weed control should be less than significant.

Cage culture operations may use anti-fouling agents to inhibit growth of aquatic organisms on nets and other structures. The use of the common anti-fouling agents tributyltin and copper is regulated through the California Food and Agriculture Code Sections 6900, 6910 and 6920. An example of a mitigation measure implemented by a RWQCB regarding the conditional operation of an aquaculture facility was a requirement that any in-water use of anti-fouling agents, biocides and preservatives be conducted such that potential impacts are maintained at less-than-significant levels (HBHRCD 1999).

5.8.3.3 Chemicals for Site Maintenance

Oil and fuel may be stored on site for use in mechanized equipment. There may be also be small amounts of pesticides and herbicides that are kept on hand for pest control and weed maintenance. The typical quantities of these materials used at an aquaculture facility are small and the potential impact from spill is less than significant.

5.9 HYDROLOGY AND WATER QUALITY

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Violate any water quality standards or waste discharge requirements?	☐	☒	☐	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted?	☐	☒	☐	☐
c) Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☒	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☒	☐	☐
e) Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☐	☒	☐	☐
f) Otherwise substantially degrade water quality?	☐	☐	☒	☐
g) Place housing within a 100-year flood hazard area as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☒	☐
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Cause inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

5.9.1 Environmental Setting

Water supply and water quality are critical components of any aquaculture project. From initial purchase through final sale, the products of this industry are living aquatic organisms with specific biological demands for and sensitivities toward water-borne

materials. If water quality conditions become degraded with respect to any biological tolerance of the cultured product, there may be an immediate impact to the health of the organism. Because of this response, the water quality conditions in water supply sources for aquaculture facilities tends to be of excellent quality or require only minimal treatment before use. Further, the water quality within an aquaculture facility exhibits a self-regulating process. If facility operations produce poor water quality within the rearing units, the result may be a reduced productivity or total loss of product.

Land-based culture methods require water diversion from a ground water or surface water source. The diverted water is used in the rearing units in single-pass, multiple-pass, or recirculated fashion depending on the configuration and operation of the facility. Most diverted water will eventually be discharged from the site, though some may be lost through evaporation or leakage. With some facilities, discharges may occur only intermittently following completion of a batch culture operation, or they may occur to an irrigation channel that uses the discharge water for land application. Inland aquaculture facilities that utilize in-water cage culture do not divert any water from the natural water course.

Cage culture facilities are typically located in a lake, river or cooling water canal. Drainage patterns through these areas are affected by the geomorphology and hydrologic conditions of the upstream drainage basin. Placement of facilities within these zones has the potential to impact existing drainage patterns, siltation conditions, and hydraulic capacity.

Drainage from proposed sites for land-based culture methods will be limited to storm water runoff, plus any water diverted to the site from groundwater sources or from off-site surface water sources. The area of the drainage basin contributing to the storm water runoff is a site-specific condition that may range from less than an acre to hundreds of acres.

5.9.2 Regulatory Framework

The California Water Code, part of the statutory law for the State, contains provisions which control almost every consideration of water and its use. The control of water quality is regulated primarily through Division 7 of the Code, also referred to as the "Porter-Cologne Water Quality Control Act." The Act recognized that the statewide program for water quality could most effectively be administered regionally within a framework of statewide coordination and policy, and consequently established the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs) as the principal State agencies responsible for control of water quality (CRBRWQCB 1994).

The Federal Clean Water Act (Public Law 92-500, as amended) provides for the delegation of certain responsibilities of water quality control and water quality planning to the states. Where the USEPA and the State Board have agreed to such delegation, the Regional Boards implement portions of the Clean Water Act, such as the NPDES program and toxic substance control programs.

Each RWQCB has formulated and adopted, for its region, a Basin Plan which a) identifies statewide and Federal plans that are relevant to the region, and b) establishes such water quality objectives as in its judgement will ensure reasonable protection of beneficial uses of water of the State. These Basin Plans are subject to continuous review

and update as necessary. Updated sections of plans are subject to review by both the SWRCB and the USEPA.

A basic policy established by California's nine Basin Plans is that designated beneficial uses of State waters may not be degraded. Within each Basin Plan, a specific listing of designated beneficial uses is provided for each major hydrologic unit. Many beneficial uses that are common in the Basin Plans are listed in Table 5-2, along with the category abbreviation and definition.

One of the designated beneficial uses of State waters is Aquaculture, defined as the "uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes." Another beneficial use category is Shellfish Harvesting, defined as "uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g. clams, oysters, mussels) for human consumption, commercial, or sport purposes." The Aquaculture and Shellfish Harvesting categories are designated as existing beneficial uses in seven and six Basin Plans, respectively, as indicated in Table 5-3. Aquaculture projects located in hydrologic units where Aquaculture or Shellfish Harvesting are designated beneficial uses have a legal assurance that their water supply sources cannot be degraded without consideration of impacts to their aquaculture operations.

The intent of the Basin Plans is to optimize the beneficial uses of State waters by describing the water quality that must be maintained to support such uses. The implementation of these water quality standards is accomplished by the RWQCB by issuing and enforcing waste discharge requirements (WDRs) to individuals, communities, or businesses whose waste discharges may affect water quality. In addition, the RWQCB will administer any National Pollutant Discharge Elimination System (NPDES) permits required under the federal Clean Water Act (CWA), through the authority vested by the USEPA and SWRCB. Compliance with WDR and NPDES permit conditions insures that waste discharges from aquaculture projects will not produce significant impacts to other beneficial uses within the hydrologic unit.

The protection of certain inland waters has been assigned to the US Army Corps of Engineers (COE) under two Federal laws. Section 10 of the Rivers and Harbors Act regulates all activities that may affect a navigable water. The discharge of dredged or fill material in California's waters and wetlands is regulated under Section 404 of the CWA and additionally requires Water Quality Certification under Section 401 of the CWA.

The USEPA is currently considering development of national effluent limitation guidelines for land-based and marine aquaculture facilities. These guidelines may assess technologies currently available to reduce pollutants from aquaculture wastewater discharge, reflecting a shift in priorities from toxic metals and organics to siltation, nutrients and pathogens. At present, there are many possible outcomes of the rulemaking process, ranging from no regulation, to regulation of certain subcategories, to regulation of the entire industry. Proposed rules are scheduled for release in June 2002, with final ruling expected by June 2004 (USEPA 2001).

Table 5-2. Common designated beneficial uses for California's Basin Plans.

Beneficial Use	Description
Agriculture Supply (AGR)	Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
Industrial Service Supply (IND)	Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.
Water Contact Recreation (REC-1)	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white-water activities, fishing, or use of natural hot springs.
Non-Contact Water Recreation (REC-2)	Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
Commercial and Sport Fishing (COMM)	Uses of water to support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic, vegetation, fish or wildlife, including invertebrates.
Wildlife Habitat (WILD)	Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses of organisms intended for human consumption or bait purposes.
Cold Freshwater Habitat (COLD)	Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
Rare, Threatened, or Endangered Species (RARE)	Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under State or Federal law as rare, threatened, or endangered.
Migration of Aquatic Organisms (MIGR)	Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.
Spawning, Reproduction, and/or Early Development (SPWN)	Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.
Estuarine Habitat (EST)	Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).
Aquaculture (AQUA)	Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.
Navigation (NAV)	Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.
Marine Habitat (MAR)	Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).
Shellfish Harvesting (SHELL)	Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, mussels) for human consumption, commercial, or sport purposes.

Table 5-3. Current status of the Aquaculture beneficial use designation in California's nine Basin Plans.

Basin Plan	Aquaculture Beneficial Use Designation
North Coast Region Basin Plan	Existing
San Francisco Bay Region Basin Plan	Existing
Central Coast Region Basin Plan	Existing
Los Angeles Region Basin Plan	Existing
Central Valley Region Basin Plan	Not Identified
Lahontan Region Basin Plan	Existing
Colorado River Basin Region Basin Plan	Existing
Santa Ana Region Basin Plan	Not Identified
San Diego Region Basin Plan	Existing

5.9.3 Environmental Impacts

5.9.3.1 Water Supply Systems

Water supply systems for inland aquaculture facilities are limited to land-based rearing methods. Facilities that use cage culture methods conduct operations directly in open water and therefore do not require constructed water supply systems.

The flow rate of water required for land-based rearing methods is dependent on the function and size of the facility. Culture involving extensive pond culture, broodstock conditioning, hatchery rearing, or algae production, for example, may be conducted as batch operations requiring only intermittent intake of a few hundred gallons of water. Intensive culture operations, on the other hand, generally require a continuous, flow-through supply of water.

Siting of a surface water supply intake for aquaculture use must consider factors of quality and access. Since the cultured organisms require consistent high quality water, it is usually not suitable to site intakes in areas with high industrial development, areas with large fluctuations in water quality due to runoff or river flow, or areas with extensive runoff from agricultural fields. Facilities that culture especially sensitive species may prefer intake sites that are largely devoid of algae, since the algae may compete with species under culture or rupture within the system and create conditions that are prone to bacterial growth (MSATS 2000a). To insure uninterrupted water supply, intakes must be located beneath the lowest level of the surface water source, with additional depth as required to meet the demands of system pumps, pipelines, and ancillary equipment.

5.9.3.2 Waste Discharges

The predominant wastes from aquaculture facilities are excess, uneaten feed (where feed is added to the system) and the metabolic by-products of feed digestion by the cultured organism. (The use of medications and cleaning agents in aquaculture facilities are discussed in Section 5.8, Hazards and Hazardous Materials.) The chemical

makeup of these wastes include organic carbon and organic nitrogen compounds present in the proteins, fats and carbohydrates of feed and feces, plus ammonium, urea, bicarbonate and phosphates (Pillay 1992). Excess feed and feces are introduced into the water as solids that soon differentiate into soluble (dissolved) solids, suspended solids, and settleable solids that may fall to the bottom as sediment. These wastes have the potential to create oxygen deficits in the receiving water due to the decay of organic solids and the creation of favorable conditions for aquatic plant growth (USEPA 1998). In severe cases, the accumulation of sediment has affected water flow (Pillay 1992).

The four methods of inland aquaculture production can be grouped into two categories that exhibit very similar discharge characteristics due to similarities in waste dispersal. The first category consists of land-based rearing methods, characterized by a waste stream discharged as a point-source. The second category consists of cage culture, which relies on open water to disperse metabolic wastes.

5.9.3.2.1 Land-Based Rearing Methods

Land-based rearing methods used for inland aquaculture production share common waste discharge characteristics in that the effluent discharge constitutes a point-source loading, unlike the waste dispersal that occurs with in-water rearing methods. The primary discharges from land-based facilities are uneaten feed and the metabolic wastes of this feed. The chemical characteristics of these wastes that have the greatest potential to impact receiving waters include biological oxygen demand (BOD), total suspended solids (TSS), nitrogen, and phosphorus. Typical loading rates for these parameters have been established for several types aquaculture production, such as salmon net pen facilities (USEPA 1992) and freshwater trout production (Piper et al. 1982; Castledine 1986). Without proper treatment, these waste loads have potential to impact macroinvertebrates and benthic communities downstream of the discharge point (Loch et al. 1996; Selong and Helfrich 1998), typically as a result of sediment accumulation. A more detailed discussion regarding impact mechanisms, monitoring, and protection of benthic communities is provided in Section 5.5.3.2.2.

Some of the particulate waste generated from excess feed and feces will typically settle out within the rearing unit of a land-based facility, unless there are very strong water currents to provide continuous flushing of the waste. With intensive culture methods, it is generally necessary to conduct periodic cleaning operations to remove accumulated waste, at intervals ranging from daily to seasonally depending on rate of deposition. There is strong incentive to conduct this maintenance as needed , since rearing units not cleaned on a regular basis run the risk of developing poor water quality conditions that can inhibit fish growth and in extreme cases result in catastrophic loss of product.

Several techniques have been developed for land-based aquaculture facilities that aim to facilitate tank cleaning as well as minimize waste load impacts to the receiving water. The relevance of these techniques are dependent on project-specific traits such as total flow rate, land availability, product density, and tank dimensions. Sample techniques include:

- Full-flow settling ponds, in which the entire effluent flow is passed through a settling pond prior to discharge. Solids are periodically removed from the settling pond to assure adequate retention volume.
- Off-line settling ponds, which receive flow only from cleaning operations. Cleaning

wastes are diverted to the treatment pond using separate pipelines other than the normal overflow drains. A common method for collecting the wastes is the use of a vacuum-type suction wand.

- In-pond settling, feasible in large ponds having low flow, where the pond itself acts as a settling pond. After fish harvest, water is diverted around the pond to allow removal of solids.

Regardless of the selected treatment method, all waste discharges must comply with waste discharge requirements (WDRs) established by the local RWQBC. Projects discharging to navigable waterways and intending to produce more than 20,000 pounds of cold water organisms or 100,000 pounds of warm water organisms each year will also be required to obtain a NPDES permit. In California, these permits are administered through the RWQCB. Discharge characteristics that are commonly regulated in these permits include total suspended solids (TSS), settleable solids, dissolved oxygen, pH, and temperature. Since these facilities will be in compliance with discharge standards, potential impacts to water quality will be less than significant. In many cases, the facility will use common methods of waste treatment to mitigate the impacts to the less than significant condition.

5.9.3.2.2 Cage Culture

The primary discharges from cage facilities are uneaten fish feed and the metabolic wastes of this feed. Just like the concerns noted in the previous subsection for land-based rearing methods, the chemical characteristics of these wastes that have the greatest potential to impact receiving waters include biological oxygen demand (BOD), total suspended solids (TSS), nitrogen, and phosphorus. The TSS and phosphorus compounds are primarily settleable solids, while the BOD and nitrogen loads consist predominantly of dissolved materials. Several studies examining the waste loading and waste fraction distribution from marine salmonid cage culture facilities were reviewed by USEPA (1992) to suggest the following average waste loading conditions:

Parameter	Waste Loading (lbs/lbs fish/yr)	Dissolved Fraction	Settleable Fraction
BOD	0.400	75%	25%
TSS	0.800	14%	86%
Total N	0.080	83%	17%
Total P	0.012	14%	86%

Cage culture relies on a continual flushing from the surrounding open water to disperse wastes away from the cage area. As a consequence, water depth, bottom topography, currents, and wave action all play a significant role in determining waste impacts. With inadequate flushing, the dissolved wastes from cage facilities have the potential to adversely affect aquatic organisms in the area, including the cultured organisms themselves. The settleable solids have the potential to accumulate on the bottom under the cages, initially producing enriched sediments. If the rate of enrichment exceeds the rate at which biota can assimilate the wastes, degrading sediments will result in anoxia, the production of hydrogen sulfide and methane gases. Such conditions are toxic to most benthic organisms (BCEAO 1997).

The discharge related impacts of cage culture can be successfully mitigated through effective best management practices (BMPs). By careful feed management, the use of

appropriate stocking densities, careful monitoring of environmental conditions and stock health, and other appropriate BMPs, aquaculture activities can minimize potential impacts on the environment. Section 5.5.3.2.2 provides a discussion of monitoring practices that have been implemented in Washington State to assure there is no significant impact to the benthic communities surrounding salmon net-pens.

The implementation of regulations regarding siting and sizing of cage facilities has been one means of preventing waste discharge impacts from these facilities. In Washington, the minimum water depth and mean current velocity for a given site determine the maximum allowable annual production from a floating cage facility (WDOE 1986). In this way, the probable waste load from the facility is maintained below the expected rate of waste assimilation in the sediment. In addition, Washington requires that all commercial cage facilities, regardless of annual production or monthly feed level, conduct periodic environmental monitoring to characterize any environmental impacts resulting from the cage operations and to assure compliance with State Water Quality Standards and applicable Sediment Quality Standards (WDOE 1997).

Cage culture facilities will be required to obtain a waste discharge requirement (WDR) permit. In addition, facilities that produce more than 20,000 pounds of cold water organisms or 100,000 pounds of warm water organisms each year are usually required to obtain a NPDES permit. In California, these permits are administered through the RWQCB. Discharge characteristics that are commonly regulated in these permits include total suspended solids (TSS), settleable solids, dissolved oxygen, pH, and temperature. Since these facilities will be in compliance with discharge standards, potential impacts to water quality will be less than significant.

5.9.3.3 Storm Water Discharges

In 1990 the USEPA established regulations that require NPDES permits for discharge of storm water associated with certain industrial activities. The only activity within the regulations that has relevance to aquaculture projects is construction activities that disturb five or more acres of land. NPDES permits in California are administered by the SWRCB, which has elected to implement the construction activities discharge permit by adopting a statewide General Permit. The General Permit requires all dischargers where construction activity disturbs five acres or more to:

- Develop and implement a Storm Water Pollution Prevention Plan (SWPPP) which specifies Best Management Practices (BMPs) that will prevent all construction pollutants from contacting storm water and with the intent of keeping all products of erosion from moving off site into receiving waters.
- Eliminate or reduce nonstorm water discharges to storm sewer systems and other waters of the nation.
- Perform inspections of all BMPs.

The review and approval of General Permit applications is the responsibility of the local RWQCB. Implementation and oversight of the SWPPP throughout the life of the construction activity will provide effective pollution prevention for storm water discharges and will ensure compliance with the Clean Water Act and the California Water Code. As a result, potential impacts to water quality deriving from storm water discharges from aquaculture facilities will be less than significant.

5.9.3.4 Construction Activities

Temporary impacts to water quality may occur during construction of an aquaculture project as a result of ground disturbance activities. Construction for land-based rearing methods will often involve the installation of water intake structures and outfall structures. Construction on natural waterways may require a CDFG Streambed Alteration Agreement. If the Department determines that the construction activities may produce a significant adverse impact to water quality, then conditions would be imposed in the permit to mitigate those impacts to less than significant levels. In addition, if any facilities lie within a jurisdictional wetland or in navigable waters of the US, it will be necessary to obtain an approved USCOE permit. Facilities using land-based rearing methods are consequently expected to undergo CDFG and Corps permit review processes that will reduce potential impacts from construction to less than significant levels. In addition, land-based facilities will involve construction activities at upland locations. When these activities involve clearing, excavation, and grading that result in a land disturbance of five acres or more, it will be necessary to obtain an NPDES permit to address storm water discharges as described in Section 5.9.3.3. Between the CDFG, USCOE and NPDES permits, all potentially significant adverse impacts from construction activities at land-based aquaculture facilities will reduced to levels that are less than significant.

Construction of facilities for in-water cage culture will typically be limited to anchoring the cages and other small support structures to the substrate. These activities would result in a short-term suspension of substrate particles. Estimates of the sedimentation rate for such activities have not been identified at this time, but it is anticipated that levels would be less than the normal siltation and resuspension of sediment that occurs with natural storm events. Construction of in-water facilities will require a Streambed Alteration Agreement from CDFG. If the Department determines that the construction activities may produce a significant adverse impact to water quality, then conditions would be imposed in the permit to mitigate those impacts to less than significant levels.

5.9.4 Summary Discussion of Thresholds of Significance and Mitigation Measures

The potential for an inland aquaculture facility to have a significant adverse effect on hydrology and water quality has been discussed in the preceding subsections from a programmatic basis, focusing on four issues that most commonly arise with these types of projects. The specific extent to which these effects may occur, and the mitigation measures that will successfully reduce these effects to a level that is less than significant, will be dependent on site-specific characteristics. During review of an individual aquaculture project, the local agency and all responsible agencies will ensure these site-specific features comply with the relevant laws establishing their respective permit authority. The following table reiterates the hydrology and water quality issues raised in the environmental checklist and in the preceding subsections, provides a general threshold of significance, and summarizes mitigation measures that, when necessary, can be applied on a case-by-case basis to reduce the hydrology and water quality impacts to levels that are less than significant.

Issue	Potential Threshold of Significance	Potential Mitigation Measures to Reduce Impact to Less than Significant
Groundwater depletion	Proposed well system has withdrawal rate large enough to suggest potential lowering of the local groundwater table level	• Provide results of well test indicating acceptable level of impact on pre-existing nearby wells • Revise proposed withdrawal rate to avoid or minimize impact
Water quality and waste discharge	Projected waste discharge characteristics exceed water quality standards of receiving water	• Comply with conditions of approved WDR and NPDES permits (as warranted) • Land-based facilities can use settling ponds or other methods to reduce solids loading • Cage culture might entail monitoring to ensure adequate dispersal of wastes
Erosion and siltation	Proposed project construction disturbs five or more acres of land, and/or requires installation of in-water structures	• Implement Storm Water Pollution Prevention Plan • Comply with conditions of approved Streambed Alteration Agreement and/or Corps permit (as warranted)
Stormwater drainage	Proposed site development alters rate or volume of stormwater drainage	• Provide stormwater detention facilities as required by local ordinances
Increase in flood potential	Proposed project involves in-water structures that significantly alter cross-sectional area of stream or river	• Provide engineering report indicating acceptable level of change to upstream and downstream surface water profiles
Exposure to flood hazard	Proposed project places housing in 100-year flood hazard area or presents significant risk of loss people or structures due to flooding	• Relocate housing outside of flood hazard area • Avoid or minimize operations and structures inside the flood hazard area

5.10 LAND USE AND PLANNING

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with applicable environmental plans, policies, or regulations of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☒	☐	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☒	☐	☐

5.10.1 Environmental Setting

The physical aspects of inland California are tremendously varied. Because of this diversity, inland California is comprised of many different land uses, including agriculture, residential homes, metropolitan facilities, open space, and recreation and commercial attractions.

The process requirements of the inland aquaculture include the need for water and ample land, similar to the needs of the agriculture industry. The nature of the product requires easy access to markets or processors. As a result, most inland aquaculture projects are located in agricultural or rural areas, within relatively close proximity of urban markets.

5.10.2 Regulatory Framework

Land use is regulated in California by way of planning, zoning, and subdivision controls implemented by local City and County governments. There are currently 58 counties and approximately 468 incorporated cities in California. Local government authority is granted by State law, and cities and counties have legislative power to adopt local ordinances and rules consistent with State law.

Every City and County in California has adopted a general plan to set forth policies to guide local land development. Typically the general plan contains a map that identifies the allowable land uses. Each general plan must contain seven mandatory elements covering land use, circulation, housing, open space, safety, conservation, and noise.

Proposed aquaculture projects must apply for a development permit from the City or County in which the proposed project is to be located. The City or County determines whether: 1) it complies with the City or County general plan, and 2) it is exempt from CEQA.

If it is determined that the project is inconsistent with the general plan, the developer – applicant must apply for a general plan amendment. General plan amendment procedures are as follows:

- After completing an environmental analysis of the project, the planning commission holds a public hearing on the proposal.
- At the hearing, the planning commission considers recommendations from the City or County planning department, interested agencies, and public testimony.
- After the commission completes its deliberations, it forwards a recommendation to the governing body.
- The governing body holds a public hearing on the proposal in which it may approve, deny or modify the proposed amendment after the public hearing.

If the governing body modifies the amendment, it must refer it back to the planning commission for reconsideration prior to taking final action.

5.10.3 Environmental Impacts

Aquaculture programs are classified as an agriculture land use. Each individual project must apply for a Development Permit from the local city or county planning department. Each project will be reviewed to determine consistency with the applicable general plan and to determine compliance with CEQA. If the project is not consistent with the applicable general plan, then the local agency has the authority to reject the project or require project specific mitigation and/or other project alternatives.

Inland aquaculture facilities that are developed and operated in conformance with environmental plans, policies, or regulations of agencies with jurisdiction over the project will produce cumulative impacts that are less than significant with mitigation. The possibility to conflict with any applicable habitat conservation plan or natural community conservation plan is also less than significant with mitigation.

5.11 MINERAL RESOURCES

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☒	☐
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☒	☐

5.11.1 Environmental Setting

Oil and gas are two important mineral resources found in California. According to the 2000 Annual Report published by the California Department of Conservation's Division of Oil, Gas and Geothermal Resources, the total number of producing oil and gas wells was 47,968. Of that, 1,169 were gas wells and 46,799 were oil wells (CERES 1999). California was the third largest onshore oil producer from federal lands in 2000 (BLM 2000).

California produces at least 25 types of non-fuel mineral resources including gold, sand and gravel, portland cement, diatomite, natural sodium sulfate, asbestos benitoite clay, common clay, dimension stone, crushed stone, feldspar, boron, rare earth concentrates, and tungsten. One of the top gold producers in the country, California's most important gold deposits can be found in the Sierra Nevada, Klamath Mountains and Mojave Desert. There are over 900 active mines producing non-fuel minerals in the state. Approximately 11,500 Californians work at these mines and their processing plants (CERES 1999).

5.11.2 Regulatory Framework

The State Lands Commission (SLC) leases and manages sovereign tidelands, submerged lands, and beds of navigable waterways under its jurisdiction. Anyone proposing to use such State-owned sovereign lands must first obtain a land use lease from the SLC. Authorization is also required from SLC for dredging, mining, oil, gas, or geothermal exploration activities. The lease or permit required is covered in the appropriate sections of the Public Resource Code.

5.11.3 Environmental Impacts

Construction and operation of inland aquaculture facilities has the potential to impact availability of a known mineral resource that would be of value to the region and the residents of the state or a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan. Aquaculture facilities would not likely be sited in areas currently mined for sand and gravel deposits due to dredging operations. Project applicants wanting to site an aquaculture facility within an active lease area would be responsible for contacting lease holders to resolve potential conflicts between the two operations. These resolutions would result in less than significant impacts to mineral resources.

5.12 NOISE

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Expose persons to or generate excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) Generate a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
d) Generate a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
e) Be located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, and expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐
f) Be within the vicinity of a private airstrip, and expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐

5.12.1 Environmental Setting

Noise is defined as unwanted or objectionable sound, and airborne sound can be described as a rapid fluctuation of air pressure above and below the atmospheric pressure. Sound magnitude is expressed in logarithmic (power of 10) ratios called decibels (dB). These are derived by comparing measured sound pressures to a reference pressure. The unit of measurement of frequency is Hertz (Hz) (defined as one vibration per second). The human ear responds to sounds with frequencies in the range of 20-20,000 Hz. Most audible sounds do not consist of a single frequency but rather a broad band of frequencies with each differing in sound level. The method commonly used to quantify environmental sounds consists of evaluating all of the frequencies that comprise a sound in accordance with a weighting. The weighting reflects the fact that human hearing is less sensitive at low frequencies and extreme high frequencies than in the mid-range. This is called A weighting, and the decibel level thus measured is called the A-weighting sound level (dBA).

Inland aquaculture facilities in California are likely to be located in rural areas. Agriculture is the dominant business in most of these areas, with existing noise patterns dominated by the operation of farm equipment. Other potential sources of noise in these areas could include road traffic, railroad operations, aircraft overflights, and light industrial plants.

5.12.2 Regulatory Framework

Noise standards have been established by Federal, State, and local governments. The USEPA, under the provisions of the Noise Control Act of 1972, is responsible for establishing emission standards for new products. The Noise Control Act of 1972 preempts State and local regulations.

The allowable noise exposure for industrial workers is regulated by the OSHA, and the noise standards for residential housing is published by the Department of Housing and Urban Development (HUD). For noise-sensitive land uses (e.g., residences, schools, churches, and hospitals) the majority of Federal agencies consider a 65-dBA Ldn level as a general dividing line between an acceptable and an unacceptable noise environment.

Applicable regulations that apply primarily to onsite conditions include the Cal/OSHA (Occupational Health and Safety Administration) occupational noise exposure regulations. There are no direct State regulations for offsite (i.e., environmental or community) noise control, although the Model Community Noise Control Ordinance issued in 1977 by the Department of Health Services, Office of Noise Control may be applied as a set of covenants, codes, restrictions and recommendations by HUD. The Office of Noise Control may be applied as a set of evaluation criteria. For the most part, these recommendations are similar to the provisions of the covenants, codes, restrictions and recommendations by HUD. The Office of Noise Control of the State of California, Office of Environmental Health Hazards Assessment, delineates criteria for defining "clearly acceptable" and "conditionally acceptable" daytime and nighttime noise levels for single-family and multiple-family residential and other land uses.

5.12.3 Environmental Impacts

Potential sources of noise from inland aquaculture facilities include pumps, generators, and utility and delivery vehicles. Facilities that rely on a pumped water supply are likely to have pumps operating continuously. Generators are typically used infrequently, such as during a power outage. During periods of heavy bird predation, an operator may resort to use of accoustical harassment devices to reduce product losses. Most noise would occur during daytime hours when most activity takes place. In general, inland aquaculture facilities would exhibit noise patterns that are likely to be very similar to typical agricultural farm operations.

CEQA regulations define a significant effect as an action with the potential to substantially increase the ambient noise levels for adjoining areas. Inland aquaculture facilities are expected to produce noise levels that are comparable to ambient conditions, and therefore there will be less than significant impacts to noise.

5.13 POPULATION AND HOUSING

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☒	☐
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☒	☐

5.13.1 Environmental Setting

The 2000 U. S. Census indicates that approximately 34% of the California population is located in the inland counties. The general plans for each city/county will indicate residential areas and development limitations.

Housing at an aquaculture facility is an accessory to the primary activity of the site. At the same time, housing is often included in the proposed project as a means to provide site security and as a convenience to on-call staff who may need to respond to operational emergencies. Housing is usually in the form of manufactured or conventional single-family dwelling units.

5.13.2 Regulatory Framework

Housing in inland California is primarily managed and regulated by local city and county planning departments. Any person or public agency planning a development must obtain a Development Permit from the city or county having land use authority. New development must be consistent with the local general plan, and specifically with its housing element.

5.13.3 Environmental Impacts

Most inland aquaculture facilities would be constructed in rural and agricultural areas, not within residential areas. Aquaculture businesses typically employ a small number of people, and would not result in substantial population growth in an area. The typical range of hired workforce is 5-15. Based on the general skills required to construct and operate these facilities, workers would likely be hired from the existing local workforce. Thus, aquaculture projects would result in less than significant impact to population or housing.

5.14 PUBLIC SERVICES

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
a) Fire protection?	☐	☐	☒	☐
b) Police protection?	☐	☐	☒	☐
c) Schools?	☐	☐	☒	☐
d) Parks?	☐	☐	☒	☐
e) Other public facilities?	☐	☐	☒	☐

5.14.1 Environmental Setting

Public services are typically provided to development projects by a variety of local purveyors (i.e., city, county, special district, school district). The services available vary depending on the level of development in the area. Aquaculture facilities require little or no public services. No government facilities or structures would be physically altered by construction of the proposed coastal aquaculture facilities.

5.14.2 Regulatory Framework

Regulatory guidance relates to the provision of adequate public services to meet the needs of the service area. These levels are set by local planning agencies.

5.14.3 Environmental Impacts

It is not anticipated that aquaculture facilities would require fire, police or other public facilities at a level that would impair existing service levels and response times. Due to the small number of employees required for aquaculture operations, there would be no need for new public facilities or the alteration of government facilities. Therefore, there are less than significant impacts to public services.

5.15 RECREATION

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

5.15.1 Environmental Setting

Tourism is defined as leisure vacation travel requiring transit over 50 miles or an overnight stay. Recreation is defined as leisure activities in which participants travel less than 50 miles and do not require an overnight stay. California is the first in the nation for travel earnings, domestic visitors, and overseas visitors (CERES 1999).

Based on number of visitors in 1991, the State's top ten recreational attractions are: Golden Gate National Recreation Area, Disneyland, Old Town San Diego State Historic Park, Universal Studios, Knott's Berry Farm, Yosemite National Park, Sea World, Six Flags Magic Mountain, Huntington State Beach, and Santa Cruz Beach Boardwalk. Common tourism and recreational activities that occur in California's inland areas include visits to parks, museums and historic sites; hiking and biking; camping, hunting and fishing; and water recreation (CERES 1999).

5.15.2 Regulatory Framework

Recreation resources are typically managed through Federal, State, or local governments and their respective land use plans and planning agencies. Uses of recreation resources that conflict with the intended recreational use of the managed land or water is typically deemed incompatible and not authorized. Additionally, potential impacts on recreational resources are evaluated through the CEQA process.

5.15.3 Environmental Impacts

Inland aquaculture facilities have the potential to impact recreation by obstructing public access through areas traditionally used for recreational activity. This issue would be addressed during land use review by the local agency, as discussed in Section 5.10.

Inland aquaculture projects will generally result in an insignificant increase to the existing population to an area. As a consequence, existing recreation facilities will experience an insubstantial increase in use, and there will be no need for new or expanded recreation facilities. Inland aquaculture programs will result in no impact to recreation resources.

5.16 TRANSPORTATION/TRAFFIC

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Cause an increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	☐	☒	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated road or highways?	☐	☐	☐	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Result in inadequate parking capacity?	☐	☐	☐	☒
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☒

5.16.1 Environmental Setting

California's inland roadway system is comprised of a variety of roads. Some roads are two-lane dirt roads that serve rural areas, while other roads are four lanes and have higher traffic volumes. Major highways and expressways exist throughout the state and usually provide access to the larger cities. All roads serve two primary functions – to provide access to individual parcels, and to accommodate the movement of goods, services and people. Approximately 50 percent of the state's energy consumption results from transporting both goods and people. Since 1973, the number of vehicles within the state has increased by 75 percent (California Energy Commission 2001).

Cage culture facilities will be located in lakes and rivers, some of which may be classified as navigable waters. Vessels utilizing these waters are likely to be limited to smaller commercial boats and recreational boats. The densities of boat traffic would be dependent on site-specific characteristics such as proximity to commercial harbors, public boat ramps, and recreational fishing areas (WDF 1990).

5.16.2 Regulatory Framework

Guidelines prepared by the Institute of Transportation Engineers (1988) indicate that a detailed traffic impact analysis would be warranted whenever a proposed project

would generate 100 or more additional peak-hour trips in the peak direction. In addition, any increase in peak-hour trips that would result in the reduction of the existing level of service for a road would be considered significant. Regulations relating to site access are usually contained in the general plan and ordinances of the local agency.

If the proposed aquaculture facility is located in navigable waters of the U.S. and involves any structures that might be an aid or obstruction to navigation, the project proponent must submit a permit application to the U.S. Coast Guard using the form titled **Private Aids to Navigation Application (CG-2554)**. Review of this form by the U.S. Coast Guard will determine what requirements might be placed on the proposed structures.

5.16.3 Environmental Impacts

Trucks carrying supplies and equipment will use public roads to access the facilities. A conservative estimate for a proposed inland aquaculture facilty would add about 10 trips per day, spread throughout the business day. Facility employees could potentially add about 40 peak-hour trips during travel to and from work. This low volume will cause no signigicant impact to land-based traffic.

Cage culture facilities will establish fixed objects in the water. They can impact navigation if sited in established navigation lanes, narrow channels, or where boats would be unable to navigate safely around them. In addition, if structures break loose from their anchors during severe weather conditions they could become a hazard to vessel traffic. If facilities are inadequately lighted or made visually unobtrusive, they pose a greater risk to navigating vessels and may be a significant safety hazard, especially at night or during inclement weather (WDF 1990). In-water projects located in navigable waters will be reviewed by the U.S. Coast Guard to assure there is no impact to vessel transportation.

5.17 UTILITIES AND SERVICE SYSTEMS

Would the project:	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☒
e) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
f) Comply with Federal, State, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

5.17.1 Environmental Setting

Most utilities and service systems used by aquaculture facilities are provided by local agencies or utilities. Solid waste disposal services are provided by local government or private businesses. Sewer and water services, where available, are usually provided by purveyor districts in rural areas and by municipalities in more urbanized areas. Electrical power is supplied by State regulated utilities throughout California.

5.17.2 Regulatory Framework

Regulatory guidance relates to the provision of adequate public services to meet the needs of the service area. These levels are set by local planning agencies.

5.17.3 Environmental Impacts

Inland aquaculture facilities using land-based rearing methods generally require electric power for building lighting and ventilation, site lighting, and any required water treatment equipment. Land-based facilities using well water, a pumped surface water source, or recirculation methods will require additional electrical capacity for continuous operation of the water supply pumps. Required electrical load would be comparable to or slightly greater than typical agricultural businesses, and the demand would not be expected to impact the capacity of the local utility provider. Water and wastewater requirements at land-based facilities would be primarily limited to

domestic needs for employees. Most sites for land-based facilities are located close to existing service lines for electricity, water and sewer. In remote areas without available sewer, wells and on-site septic systems may have to be installed.

Inland aquaculture facilities using in-water production methods usually require only small amounts of fresh water or electricity, if any. In-water projects located close to shore may choose to install a waterline to provide fresh water for drinking, spraying down nets, and rinsing walkways. In addition, an electric cable can power electrically-powered compressors, feeding mechanisms, and lights (WDF 1990).

When in-water projects are located a considerable distance offshore, bottled water is used for drinking. A portable pump may be used to wash down nets and walkways and other power requirements are typically addressed through intermittent use of portable generators.

Inland aquaculture facilities have an insignificant demand on electrical power, water and wastewater facilities. Therefore, the proposed action will have no impact on utilities and service systems.

5.18 GROWTH INDUCING IMPACTS

Inland aquaculture facilities generally employ small workforces (in the range of 5 to 15 per facility). The need for workers to construct and operate these facilities is insignificant compared to the existing population found in California. Because it is not a specialized industry requiring highly trained employees, the majority of the workforce would be composed of local hires. No growth inducing impacts would occur.

5.19 CUMULATIVE IMPACTS

Section 15130 (a) of the State CEQA Guidelines states that "an EIR shall discuss cumulative impacts of a project when they are significant." As defined in Section 15355, "cumulative impacts" refers to "two or more individual effects which when considered together, are considerable and which compound or increase other environmental impacts." Furthermore, Section 15130(b) states:

> *The discussion of cumulative impacts shall reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided for the effects attributable to the project alone. The discussion should be guided by the standards of practicality and reasonableness, and should focus on the cumulative impact to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact.*

For individual inland aquaculture projects, this assessment has noted that the areas in which potential environmental impacts may be most severe or are most likely to occur involve the resource categories of Biological Resources and Hydrology and Water Quality. The following list summarizes the potentially significant adverse impacts that are most likely to occur within these categories. The list also provides examples of other types of projects that may produce related impacts.

Resource Category	Potentially Significant Adverse Impact from Aquaculture Projects	Potential Other Projects Producing Related Impacts
Biological Resources	• Impact to sensitive species or sensitive habitat (such as wetlands or riparian habitat) displaced by project facilities	• Land development projects
	• Impact to aquatic organisms and in-stream habitat caused by diversion of surface water for facility use	• Irrigation projects; municipal development
	• Impact on natural aquatic populations due to accidental introduction of exotic species and/or exotic pathogens	• Shipping; agricultural imports; recreational boating
	• Impact on natural aquatic populations due to escapement and subsequent competition for habitat and food	• State and Federal fish stocking programs
Hydrology and Water Quality	• Reduction of water tables due to groundwater appropriation	• Irrigation projects; municipal development
	• Water quality impact from discharge of excess feed and feces or from pond drawdown during harvest	• Other farm animal production projects
	• Temporary increase in siltation during facility construction	• Timber harvest; agriculture crop harvest; land development

The environmental resources most likely to be affected by inland aquaculture may also be affected by many other activities unrelated to aquaculture. Loss of sensitive habitat may be a challenge to nearly all projects involving land development in California. Issues involving surface water diversion, reduction of groundwater tables, and wastewater discharges are common to many activities that require water for operations, including the agricultural industry and municipal development in general. Potential impacts involving siltation are likely to be experienced by any activity that involves substantial ground disturbance, including timber harvest, agriculture, and construction activities associated with land development. The risk of introducing exotic species and exotic pathogens is also present with the discharge of ballast water by the shipping industry, with the importation of agricultural products, and within the recreational industry due to inter-basin transfer of recreational boats. Potential impacts to natural populations arising from competition for habitat and food is affected by State and Federal fish stocking programs to a much larger scale than is possible by the accidental release of incidental fish by the private aquaculture industry.

The potential cumulative impacts that encompass the California inland aquaculture industry requires consideration of additional activities such as those described in the preceding paragraph that have potential to contribute related impacts. These activities include major land uses such as municipal development, agriculture, and forest practices, as well as fundamental recreational pastimes. Potential impacts from these other activities are mitigated through adherence to relevant ordinances or regulations (such as general plans for municipal development) and through conditions imposed during the approval process for individual projects involving these other activities. As guided by the standards of practicality and reasonableness, it is assumed these other projects have been approved on the basis that their contribution to cumulative impacts has been rendered to be less than cumulatively considerable.

Regulations to mitigate potential cumulative impacts of the California aquaculture industry have been adopted by state legislation, primarily through Fish and Game Code 15102 and through CCR Title 14, Division 1, Chapter 9, Sections 235-245. Applications for aquaculture of specific species are reviewed by DFG to ensure that accidental release will not cause a resource problem. Approval for culture of exotic species with potential to live in the wild generally is not allowed, or is permitted only in secure facilities to minimize or eliminate escape, as is appropriate to the risk represented by the species at issue. Approval for culture of native and established species is generally given only after analysis of the status of the local native population, recognizing that some animals may escape the facility. With the thorough DFG review of these statewide aquaculture issues, in conjunction with local agency review to develop appropriate mitigation to address regional and site-specific issues, the aquaculture industry is not expected to contribute to any significant cumulative impacts.

5.20 MANDATORY FINDINGS OF SIGNIFICANCE

	Potentially Significant Impact	Less-Than-Significant With Mitigation Incorporated	Less-Than-Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☐	☒	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

Proposed inland aquaculture projects undergo considerable review by resource agencies to assure that appropriate mitigation is implemented to reduce potential significant impacts that may degrade the quality of the environment; substantially reduce the habitat of a fish or wildlife species; cause a fish or wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community; reduce the number or restrict the range of a rare or endangered plant or animal; or eliminate important examples of the major periods of California history or prehistory. From a programmatic basis, these projects have no significant impact that is cumulatively considerable. Inland aquaculture projects have no impacts which will cause substantial adverse effects on human beings.

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SECTION 9. LIST OF ACRONYMS

AHD – Acoustic Harassment Device
APCD – Air Pollution Control District
APHIS – Animal and Plant Health Inspection Service within the U.S. Department of Agriculture
AQMD – Air Quality Management District
ARPA - Archeological Resources Protection Act
BOD – Biological Oxygen Demand
CARB – California Air Resources Board
CCR – California Code of Regulations
CDFG – California Department of Fish and Game
CEQA – California Environmental Quality Act
COE – U.S. Army Corps of Engineers
CVM – Center for Veterinary Medicine
DHS – Department of Health Services
DO – Dissolved Oxygen
DOC – Department of Commerce
DOI – Department of the Interior
EIR – Environmental Impact Report
ESA – Endangered Species Act
FDA – U.S. Food and Drug Administration
HUD – Department of Housing and Urban Development
INAD – Investigational New Animal Drug
JARPA – Joint Aquatic Resources Permit Application
LCP – Local Coastal Plan
LRP – Low Regulatory Priority
LUP – Land Use Plan
NAAQS – National Ambient Air Quality Standards
NAHA – Native American Heritage Act
NAHC – Native American Heritage Commission
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NMFS – National Marine Fisheries Service
NOD – Notice of Determination
NPDES – National Pollution Discharge Elimination System Permit
NRHP – National Register of Historic Places
NSSP – National Shellfish Sanitation Program
OSHA – Occupational Safety and Health Administration
PEIR – Program Environmental Impact Report
PSA – Permit Streamlining Act
RWQCB – Regional Water Quality Control Board
SAAQS – State Ambient Air Quality Standards
SHPO – State Historic Preservation Office
SLC – State Lands Commission
SWRCB – State Water Resources Control Board
TSS – Total Suspended Solids
USDA – U.S. Department of Agriculture

USEPA – U.S. Environmental Protection Agency
USFWS – U.S. Fish and Wildlife Service
WDF – Washington State Department of Fisheries
WDR – Waste Discharge Requirements

SECTION 10. REFERENCES

Barlow, S. 2001. Fishmeal and Oil - Supplies and Markets. Presentation to Ground Fish Forum, October 2001. International Fishmeal and Fish Oil Organisation, UK.

Bates, K. 1993. Fishway Design Guidelines for Pacific Salmon. Working paper 1.3, 10/93. Washington Department of Fisheries. Olympia, Washington.

BCEAO (British Columbia Environmental Assessment Office). 1997. Salmon Aquaculture Review, Volume 1. http://www.eao.gov.bc.ca/project/aquacult/salmon/report.

Beveridge, M. C. M. 1987. Cage Aquaculture. Fishing News Books Ltd. Farnham, Surrey, England.

BLM (Bureau of Land Management). 2000. Oil and Gas Leasing in California. http://www.ca.blm.gov/caso/ong_stats.html (25 September 2001).

Bowden, G. 1981. Coastal Aquaculture Law and Policy, A Case Study of California. Westview Special Studies In Agriculture/Aquaculture Science and Policy, Westview Press. Boulder , Colorado.

Brown, E. E., and J. B. Gratzek. 1980. Fish Farming Handbook. Food, Bait, Tropicals and Goldfish. AVI Publishing Company, Inc. Westport, Connecticut.

Brown, V, D. Allan and J. Stark. 1987. Rocks and Minerals of California. 3rd Revised Edition. Naturegraph Publishers, Happy Camp, CA.

CAA (California Aquaculture Association). 1999. Member Directory Products and Services 1999. CAA Publications. Niland, California.

CALFED (CALFED Bay-Delta Program). 1999. Final environmental impact statement/ environmental impact report. Prepared for U.S. Bureau of Reclamation, Fish and Wildlife, National Marine Fisheries Service, EPA, Natural Resources Conservation Service, Army COE, and California Resources Agency.

California Energy Commission. 2001. March 8, 2001. www.energy.ca.gov.

CCC (California Coastal Commission). 1999. Adopted Commision Findings, Application No. E-98-17, Project Applicant Doug Hayes (Pacific Offshore Farms). California Coastal Commission. San Francisco, California.

CDFG (California Department of Fish and Game). 1997. Fish screening criteria. April 14, 1997. California Department of Fish and Game. Sacramento, California.

CDFG. 2000. Guidelines for assessing the effects of proposed projects on rare, threatened, and endangered plants and natural communities. Revised May 8, 2000. California Department of Fish and Game, Sacramento, California.

CDFG. 2001. California Wildlife Habitat Relationships. September 28, 2001. http://www.dfg.ca.gov/whdab/html/cwhr.html.

CERES (California Environmental Resources Evaluation System). 1995. California Wetlands. Last updated: May 2, 1995. http://ceres.ca.gov/ceres/calweb/wetlands.

CERES. 1999. California Wetlands. http://ceres.ca.gov/ceres/calweb/coastal.

Chartkoff, J.L. and K.K. Chartkoff. 1984. The Archaeology of California. Stanford University Press, Stanford, California.

Chipping, D. 2001. A Guide to the Biotic Zones of California and their Dominant Plant Communities. California Native Plant Society. http://www.calpoly.edu/~dchippin/zonation.html (26 Sept. 2001).

Conte, F. S., Harbell, S. C., and R. L. RaLonde. 1996. Oyster Culture, Fundamentals and Technologies of the West Coast Industry. Western Regional Aquaculture Center. Seattle, Washington.

COPA (California Office of Permit Assistance). 1997. California Permit Handbook 1996/97. Office of Permit Assistance, California Technology, Trade & Commerce Agency. Sacramento, California. (also available through http://www.commerce.ca.gov/permitassistance/).

CRBRWQCB (Colorado River Basin Regional Water Quality Control Board). 1994. Water Quality Control Plan, Colorado River Basin – Region 7. State Water Resources Control Board. Palm Desert, CA.

Culver, C. S., Kuris, A. M., and B. Beede. 1997. Identification and Management of the Exotic Sabellid Pest in California Cultured Abalone. California Sea Grant College System Publication T-041.

Doyle, Roger. 1997. Freshwater Fish at Risk in the U.S. Scientific American. http://www.sciam.com/1297issue/1297scicit7.html (27 Sept. 2001).

Glahn, J.F., B. Dorr and M.E. Tobin. 2000. Captive great blue heron predation on farmed channel catfish fingerlings. North American Journal of Aquaculture 62:149-156.

Glude, J.B. 1979. Oyster Culture – A World Review Pages 325 – 331 in T. V. R. Pillay and W. A. Dill editors. Advances in Aquaculture. Food and Agriculture Organization of the United Nations by Fishing News Books Ltd. Rome, Italy.

Goldburg, R. and T. Triplett. 1997. Murky Waters: Environmental Effects of Aquaculture in the United States. Environmental Defense Fund, New York, New York.

Goldburg, R.J., M.S. Elliott, R.L. Naylor. 2001. Marine Aquaculture in the United States: Environmental Impacts and Policy Options. Pew Oceans Commission, Arlington, Virginia.GOPR (Governor's Office of Planning and Research). 1998. Circulation and Notice Under the California Environmental Quality Act. CEQA Technical Advise Series. Governor's Office of Planning and Research. Sacramento, California.

Haamer, J. 1996. Improving water quality in a eutrophied fjord system with mussel farming. Ambio. Vol. 25, pp. 356 – 362.

Harden, D.R. 1998. California Geology. Prentice-Hall, Inc., Upper Saddle River, NJ.

Hardy, R.H. 2000. Fish, feeds, & nutrition in the new millennium. Aquaculture Magazine 26(1):85–89.

HBHRCD (Humboldt Bay Harbor, Recreation and Conservation District). 1999. Draft Mitigated Negative Declaration. Coast Seafoods Mariculture Application, Humboldt Bay, California. Eureka, California.

Hedrick, R. P. 2001. Infectious Diseases and Their Impacts on Aquaculture. Presentation to the California Aquaculture Association, March 20, 2001.

Hedrick, R. P. 1997. Shipping Live Aquatic Products: Impacts of Regulations on Aquaculture. Presentation to the California Aquaculture Association.

ICAD (Interagency Committee for Aquaculture Development, State of California). 1994. A Guide to California State Permits, Licenses, Laws and Regulations affecting California's Aquaculture Industry. Department of Fish and Game, Sacramento, California.

Imai, T. 1978. Aquaculture in Shallow Seas: Progress in Shallow Sea Culture. Translated from Japanese. A. A. Balkema. Rotterdam.

Journal of Aquatic Animal Health. 1998. Pathogens and Diseases of Fish in Aquatic Ecosystems: Implications in Fisheries Management, Portland, Oregon. Volume 10: 95-219.

Koganezawa, A. 1979. The Status of Pacific Oyster Culture in Japan. Pages 332 – 337 in T. V. R. Pillay and W. A. Dill editors. Advances in Aquaculture. Food and Agriculture Organization of the United Nations by Fishing News Books Ltd. Rome, Italy.

Korringa, P. 1979. Economic Aspects of Mussel Farming Pages 371 – 378 in T. V. R. Pillay and W. A. Dill editors. Advances in Aquaculture. Food and Agriculture Organization of the United Nations by Fishing News Books Ltd. Rome, Italy.

Leitritz, E., and R. C. Lewis. 1980. Trout and Salmon Culture, Hatchery Methods. California Fish Bulletin Number 164. The Regents of the University of California. Oakland, California.

Littauer, G. 1990. Avian predators. Frightening techniques for reducing bird damage at aquaculture facilities. Southern Regional Aquaculture Center Publication No. 401.

McBride, S. C. 1998. Current Status of Abalone Aquaculture in the Californias. Journal of Shellfish Research, Vol. 17, No. 3, 593-600.

McBride, S.C., and F.S. Conte. 1996. California Abalone Aquaculture. California Aquaculture, University of California, Davis. ASAQ-A10.

Missouri Department of Natural Resources. 1999. Missouri Aquaculture Environmental and Regulatory Guide, A Guide to Regulatory Compliance, Sources of Information and Assistance and Answers to Environmental Questions for Aquaculture Businesses in Missouri. Jefferson City, Missouri.

Moratto, M.J. 1984. California Archaeology. Academic Press, Orlando.

MSATS (Mulluscan Shellfish Aquaculture Technical Subgroup, Aquaculture Effluent Task Force, Joint Subcommittee on Aquaculture). 2000a. Response to EPA's Aquaculture Industry Regulatory Development Data Needs. June 16, 2000.

MSATS (Mulluscan Shellfish Aquaculture Technical Subgroup, Aquaculture Effluent Task Force, Joint Subcommittee on Aquaculture). 2000b. Response to EPA's Aquaculture Industry Regulatory Development Data Needs. August 15, 2000 Addendum.

Newell, C. R. and S. E. Shumway. 1993. Grazing of natural particulates by bivalve mollusks. NATO ASI Series, Vol. G33. Bivalve filter feeders in estuarine and coastal ecosystem processes, edited by R. F. Dame. Springer-Verlag Berlin Heidelberg.

NPS (National Park Service). 2001a. Mojave National Preserve. http://www.nps.gov/moja/ (27 Sept 2001).

NPS. 2001b. Tule Elk. Point Reyes National Seashore. http://www.nps.gov/pore/resources/natural/elk.htm (27 Sept 2001).

OCEAN (California Ocean and Coastal Environmental Assess Network). 1999. http://ceres.ca.gov/ocean.

Pillay, T.V.R. 1992. Aquaculture and the Environment. Halsted Press. New York.

Piper, R. G., B. M. Ivan, L. E. Orme, J. P. McCraren, L. G. Fowler, and J. R. Leonard. 1982. Fish Hatchery Management. United States Department of the Interior. Fish and Wildlife Service. Washington, D. C.

Quayle, B.B. 1988. Pacific Oyster Culture in British Columbia. Department of Fisheries and Oceans. Ottawa.

Scottish Executive Central Research Unit. 2002. Review and Synthesis of the Environmental Impacts of Aquaculture. Central Research Unit, Edinburgh, Scotland.

Soderberg, R. W. 1995. Flowing Water Fish Culture. CRC Press, Inc. Boca Raton, FL.

Somerset, I. J. Understanding Technology Series. Understanding Aquaculture, Technical Paper #52. http://idh.vita.org/pubs/docs/aquacult.html. August 30, 2000.

Staff, F. 1983. Fish Culture Manual. Reference manual. Alaska Department of Fish and Gam Division of Fisheries Rehabilitation, Enhancement and Development. Juneau, Alaska.

State of Washington. 1998. Aquatic Nuisance Species Management Plan. Prepared by: The Washington Aquatic Nuisance Species Planning Committee – Chaired by Scott S. Smith, WDFW.

Stickley, A.R. Jr. 1990. Avian predators on southern aquaculture. Southern Regional Aquaculture Center Publication No. 400.

Stickney, R. R. 1979. Principles of Warmwater Aquaculture. A Wiley-Interscience Publication.

Stickney, R. R. 1986. Culture of Nonsalmonid Freshwater Fishes. CRC Press, Inc. Boca Raton, FL.

Stickney, R. R. 1991. Culture of Salmonid Fishes. CRC Press, Inc., Boca Raton, FL. Washington State Department of Fisheries (WDF). 1990. Final programmatic environmental impact statement - fish culture in floating net pens. Prepared by Parametrix, Inc., Bellevue, WA.

Tenore, K. R. and W. M. Dunstan. 1973. Comparison of feeding and biodeposition of three bivalves at different food levels. Marine Biology 21, pp. 157 – 165.

Toba, D. R. and K. K. Chew. 1999. Western regional aquaculture industry situation and outlook report, volume 5 (through 1997). Western Regional Aquaculture Center, Seattle, Washington.

USDA (U. S. Department of Agriculture). 2000. 1998 Census of Aquaculture. http://www.nass.usda.gov/census/census97/aquaculture/aquaculture.htm (July 11, 2000).

USEPA (U.S. Environmental Protection Agency). 1992. Collection and treatment technologies for in-water salmonid production facilities. Draft . Prepared by FishPro, Inc. and Woodward-Clyde for US EPA Region 10, Seattle, Washington. EPA contract 68-C8-0034, Work Assignment 2-26.

USEPA. 1998. Public notice of proposed issuance of a national pollutant discharge elimination system (NPDES) permit to discharge to waters of the United States and notice of State certification for aquaculture facilities and associated, on-site fish processing facilities operating in Idaho. April 10, 1998. Seattle, Washington.

USEPA. 2001. EPA responses to Frequently Asked Questions (FAQs). Aquaculture Effluents Task Force, Joint Subcommittee on Aquaculture. http://ag.ansc.purdue.edu/aquanic/jsa/effluents/.

Veirs, S. D. Jr., P. A. Opler, D. S. Gilmer, D. M. Graber, T. Graham, L. S. Huckaby, M. R. Jennings, K. McEachern, P. B. Moyle, R. A. Stefani. 1998. Status and Trends of the Nation's Biological Resources. *California*. United States Geological Service. http://biology.usgs.gov/s%2bt/SNT/noframe/cal62.htm (18 Sept. 2001).

WDF (Washington State Department of Fisheries). 1990. Final programmatic environmental impact statement; fish culture in floating net pens. Prepared by Parametrix, Inc. Bellevue, WA.

WDOE (Washington Department of Ecology). 1986. Recommended interim guidelines for management of salmon net-pens culture in Puget Sound. 87-5. Olympia, WA.

WDOE. 1997. Briefsheet: Marine salmon net-pens. Publication No. 97-2015-WQ&FA. Olympia, WA.